TELEPHONE ENGINEER

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TINY COST OF ASSOCIATION BENEFITS

We have amused ourselves by putting together certain figures presented by officials of the United States Independent Telephone Association at the Chicago convention and have found some rather interesting results. For instance, President MacKinnon showed that there were 181 member companies of the association in Class A, B and C; that these companies operate 1,200,000 stations and have a gross income of $43,000,000 annually. Secretary Deering gave the gross revenue of the association at about $50,000 annually.

Even if the entire revenue of the association were derived from operating companies—which is not true—and none of the 400 smaller companies contributed anything—which is also not true—it seems that the cost of the activities of the National association amounts to the large sum of 4 cents per year per telephone for each of the 181 Class A, B and C companies.

Since percentage methods of computing general services to telephone companies apply—witness the 4½% of the Bell system—we tried the percentage method and our investigations led us to the conclusion that if the 181 companies bore the entire expense of the national association, the cost to them would be one hundred and sixteen, one-thousandths of one per cent of their gross revenue.

We then tried to figure out just how much expert assistance in accounting, plant and traffic, backed by the best brains and the accumulated experience of 30 years of the telephone industry could be purchased for four cents per telephone per year or for a little over one-tenth of one per cent of the gross revenue of the industry, but figures failed us. If it had to be purchased at market prices for expert advice, the amount would be infinitesimally small.

Certainly, the cost of association activities is not excessive and the benefits can be made to be very great to the individual company that will take advantage of them. Furthermore, they can be multiplied many times at an expense which if distributed to all of the companies of the Independent group would make only a microscopic change in the financial results of any one of them.

ACCOUNTING RECOMMENDATION SHOULD BE ADOPTED

That very great divergence of practice existed in the matter of depreciation among the various telephone companies has been well known, but the extent of the variations in individual cases scarcely could have been expected to be as great as those quoted by Chairman A. C. Cragg of the accounting division of the United States Independent Telephone Association at the recent convention of the association.

Two companies made no charges to depreciation reserve, although one reported $6,600 in plant removed. Another charged $200 and set up $14,000 to the reserve account. One company charged $400 to depreciation reserve, removed $1,200 in plant and had an annual credit of $12,000. Others cited by Mr. Cragg showed similar discrepancies. Since all of these companies are in Class A, B, and C, they are large enough to require the services of a full time bookkeeper and have sufficient revenue to justify annual audits by expert accountants.

In the past, the excuse might be offered that there has been no recognized method of accounting or definite line of demarcation between replacements charged to expense and those handled through the capital and reserve accounts. It is a step toward real progress in accounting that a definite set of units now is available following the adoption by the convention of the recommendation of the accounting division.

In establishing a recommended practice, the United States Independent Telephone Association has gone as far as it can. There is no sanction by which it can enforce its recommendations. The

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adoption of the practice is up to the individual companies. With some of them it will mean a change but the change will be made promptly and cheerfully. In still other cases, it will be made grudgingly and perhaps in a few cases, the inertia will be too great and it will not be made at all.

Adopted as a recommended practice, the use of the list of units has the stamp of approval of the Independent industry and should be adopted by all Class A, B and C companies as soon as practicable. The industry should organize itself for uniformity in this, without being forced to do so by orders from regulatory bodies.

BELL AND INDEPENDENT NEGOTIATIONS

Directors of the U. S. Independent Telephone Association, having reaffirmed their position that no more Independent properties be sold to the Bell without their consent, it is understood that the Bell's protest is to be considered at a joint conference of the two interests in the near future.

It has been suggested that, in cases where public convenience may be served best by a Bell purchase, a corresponding sale of Bell property to some Independent organization be arranged, at some other point, by way of balancing the scales. To this proposition, the Bell has not assented, but the Independents have set themselves resolutely against any other alternative. The outcome of further negotiations will be awaited with interest.

LOOKING FOR MORE PROPERTIES

One of the many encouraging signs in evidence at the Chicago convention last month was the unusually large number of telephone men who said that they were in the market for additional properties. A more substantial token hardly could be asked for as regards the satisfaction which telephone men today are deriving from their business. So long as telephone men are pleased with their occupation and are making a reasonable profit out of it—to the extent that they care to add to their holdings—the telephone industry will continue to develop and improve. It is most gratifying to note this improvement in the sentiment and policy of our industry.

MAKING GOOD CONVENTIONS BETTER

The U. S. Independent Telephone Association has held many interesting and successful meetings in the past. It intends to hold many more in the future, and will do all it can to make them even greater and more attractive. It has been suggested that one means of making future conventions more attractive might lie in the development of a program that would appeal to a larger number of telephone men and their wives. To that end, some special form of entertainment might be provided for each evening and get-together luncheons held during each day of the meeting. One evening might be given over to a special program by and for the pioneer telephone men. Another evening, the entire crowd might attend a theater, while a dance and musical entertainment might serve as the attraction on still a third evening. A shopping tour also might be arranged for the ladies in attendance.

These suggestions, of course, are merely intended to illustrate the possibilities of preparing a program that would cover every day and night of a four-day convention in a manner that would most interest and benefit both the men and women of the telephone industry. A program that will bring a greater number of telephone men to conventions not only will be of more benefit to those who attend, but will make future meetings still more enticing and will please the exhibitors all the more. We may go further and say that the greater the attendance at conventions, the better and greater will the entire telephone industry become. Accordingly we hope that the committees on arrangements and entertainment for future national telephone conventions—for that matter, the various state telephone conventions—may take the matter of their programs altogether seriously and leave nothing undone that will tend to attract the maximum attendance.

TELEPHONES VS. AUTOMOBILES

It develops that in certain communities the automobile has become a serious competitor of the telephone. This competition becomes especially noticeable in those communities where some industry or another temporarily has "gone sour." To illustrate: The coal business may have suffered a slump and the men who make their living from mining and handling coal may have had their earning capacities curtailed, accordingly, for the time being. Indeed, instances have come to our attention where telephones have been ordered out by some coal men, although it appears that most of them continue to buy gasoline and operate the family flivvers. Their line of reasoning appears to be that they cannot afford to be without the "Lizzie," as a little gasoline will still take them to the grocery store and to the homes of friends and relatives where they can do, in person, the talking formerly done through the telephone exchange.

While this development has resulted in a temporary loss of subscribers in some exchanges, the other view of the situation seems to be that the majority of subscribers thus lost have not been, as a rule, of the best paying class. When they come back, as they will, on the return of better conditions in their field, it is felt that they will appreciate

Independents Show Strength

Big Meeting at Chicago States Policy of Even Trade in Bell Deals — Financing of Independents Gets Easier—Group Sessions Active

By Staff Correspondent

Chicago, Ill.—With a registration of approximately 800, the 29th annual convention of the Independent Telephone industry assembled at the Hotel Sherman on October 13th for a crowded four days.

Outstanding features of the meeting were the action of the directors in the matter of the policy of refusing to approve sales of Independent properties to the Bell companies without the return of an equivalent number of stations to Independent ownership; the adoption of a recommended set of units for depreciation accounting and the authorization of the preparation of plant accounting handbooks; announcement of the preparation of a correspondence course in telephone operating and of progress in standardization of plant and engineering practices.

The convention meetings were exceptionally well attended and the divisional meetings drew together the specialists in plant, accounting and traffic. The luncheon and entertainment of Pioneers' day provided a pleasant break in the business routine of the convention. The general sessions closed on Friday morning, Oct. 17, and the convention ended after the luncheon and conference of state telephone executives on Friday noon.

The first session was called to order by President F. B. MacKinnon and the first business was the report of Secretary-Treasurer C. C. Deering. Secretary Deering gave the financial statement of the association and membership statistics. The association now has 617 operating companies, 69 manufacturers and 42 miscellaneous members making a total of 728 members.

Following the report of the Secretary came the report of the divisional chairman. V. E. Chaney, assistant to the vice-president; Theodore Gary and Co., Kansas City, Mo., read the report of the accounting division in the absence of A. C. Cragg, general auditor of the Tri-State T. and T. Company, of Saint Paul, general chairman of the accountants' committee. The report outlined the organization of the accountants into districts with a chairman in each district and gave the results disclosed by the district conferences. 216 companies or 56 per cent of the class A, B, and C member companies were represented at the district conferences. A great deal of variation was found between the practices of various companies and it was learned that the principal differences were in plant accounting practices. It was recommended that the work be continued during the coming year. Among the lines of work proposed were the study of proposed changes in the Interstate Commerce Commission accounting system, the rearrangement of Class C accounts so that there would be a natural change when a company changes into class B, and the preparation of a plant accounting handbook.

Chairman A. L. Stadermann of the plant division presented his reports showing progress during the past year. The plant division has continued its co-operation with the American Engineering Standards Committee and has become affiliated with the American Committee on Inductive Co-ordination during the the past year. This Committee now includes the electric light and power group, electric railway group, steam and electrified railroad group and the communication group, the latter consisting more specifically of representatives of the American T. and T. Company, the two larger telegraph companies and the United States Independent Telephone Association. In connection with the work of the American Engineering Standards Committee the following projects have been undertaken in which telephone companies are interested:

(a) Standardization of overhead line materials;

(b) Standardization of manhole frames and covers;

(c) Standardization of drawings and drafting room practices.

These projects together with those on poles and wire which have already been undertaken cover all of the more important materials of the telephone plant. Substation equipment, central office equipment, aerial and underground cable construction have not been so well covered and early and strong efforts should be made to have work started in standardization of materials in these lines.

Following Mr. Stadermann, was introduced A. L. Geiger, Washington, D. C., representative of the association, who told of the activities of the Washington office in income tax and accounting matters. Mr. Geiger stressed the importance of handling these matters through the association and of caring for correspondence promptly on account of the limited time available in which to file papers with the various bodies.

Mr. Deering reported for the Traffic Division of which he is chairman, in addition to his duties as secretary of the association. He reported extensive revision of the toll reference and text book and the preparation of a correspondence course for toll operators. During the year the national association has sent Miss Anne Barnes to a number of state association meetings for the purpose of furthering the work of the traffic division.

Report of President MacKinnon

After appointing committees on audit and nomination, President MacKinnon made his annual address in which he gave his analysis of the general situation of the Independent group of the telephone industry. In the studies that have been made of the financial position of Independent companies it has been found that the company that is well managed can finance itself and the one that is poorly managed can not be financed by anybody. Therefore the association started in 1925 to find out which companies were showing the proper net results and which were not, and to find out whether or not this is due to variations in accounting practice. Copies were made of the Interstate Commerce Commission reports of all Class A, B and C companies and the figures shown in these reports were carefully analyzed and statistics compiled for submission to the district conferences. It was found that the 181 companies in this group, on Dec. 31, 1924, were operating 1,246,000 stations, that they employed 20,000 men and women, that there was invested in fixed capital $165,000,000. The revenues amounted to $43,000,000 and the operating expenses to $29,000,000. After deductions there was available for interest and dividends $9,800,000 of which $2,776,000 was paid in interest and the remainder was available for dividends.

As a group these companies are a prosperous organization but some were below the level and others were above the average. Those that were not doing well were having difficulty in financing but they could get along as well as the others if they would inject into their business the element of concentrated manage-

ment. This group of companies has available for interest and dividends on capital, 5.3 per cent. They have been moved up from a class of doubtful security issuers to a class of security issuers whose securities are in demand. If they will move up another seven-tenths of a per cent and get on a 6 per cent basis they will be a gilt-edged proposition. The group as a whole is setting aside 4.4 per cent on fixed capital which is probably 4.5 per cent on their depreciable property—a great change over 1916 when they were setting up 3.7 per cent.

The 16 subsidiary companies and the 46 owned companies of the Bell system were in 1924, operating 11,310,000 stations which leaves in the Independent group about 4½ million stations. Further analysis shows that the bulk of the Bell stations are located in the 25 largest cities of the country. Taking out these large centers, the Independent group is operating as many stations as the Bell and the problem is to keep it intact, of building up the group, of holding up its end.

A peculiar situation has developed during the year in that responsible bond houses are circularizing the companies offering to buy the properties and to assist in financing, thus greatly disturbing the situation. They are not interested in operating the properties but want the securities to sell. There has been no thought of the future of the 20,000 men and women who make up the employes of the Independent group. This movement has not gone very far nor has it produced much in the way of results of these offers to buy, but it shows that Independent securities have become so desirable that bankers who formerly would not even think of buying an Independent stock issue now have men traveling up and down the states inquiring if he can not buy the entire property. The situation must be met from within the industry. If the properties are to be sold, men from within the industry must come forward and say that they will take them over and handle them. These are the men who will make the future of the Independent industry, who will help solve the problem and the burden the Independent association is to conserve, build up and maintain this Independent group.

Following President MacKinnon, Judge N. G. Hunter of Wabash, Ind., a former president of the association, made a brief address referring to the wonderful work that the men and women in the telephone industry are performing and congratulating the association on its choice of a presiding officer.

Cost of Service as a Rate Basis

"Shall Each Class of Service Pay Its Own Way?" was the principal topic of the Wednesday morning session, Frank Binkley, general manager of the United Home Telephone Co. of Bellefontaine, Ohio, upholding the affirmative and R. F. Wilder, commercial superintendent of the Tri-State T. and T. Company of St. Paul, the negative. Mr. Binkley predicated his presentation upon the Golden Rule of doing to others as you would have them do unto you. He gave the results of accounting studies made in his own company, which showed a loss of 50 cents per telephone per month for rural subscribers in the larger exchanges and as much as $1.00 per month in some. This condition he compared to the distribution of alms by taking away from one class to give to another. The public will not be robbed in the name of business and such malpractice will certainly restrict the development of the business.

Mr. Wilder presented another view of the situation to show that the value of the service is not measured by the cost of producing the service to the individual subscriber but that each subscriber is dependent in a measure upon every other subscriber. He expressed the opinion that certain classes are willing to pay more than the bare cost of their service in order to have access to other subscribers. Mr. Wilder's paper appears in full in this issue of TELEPHONE ENGINEER.

An active discussion of the subject followed the remainder of the morning session. Among the participants were D. M. Neill of Red Wing, Minn., A. L. Stadermann of Terre Haute, Ind., F. M. Boardman of Nevada, Iowa, G. W. Robinson of St. Paul, E. D. Glandon of Pittsfield, Ill., J. W. Safford of Troy, Ohio, and many others.

Division Conferences Attract Many

Wednesday afternoon was given over to the conferences of the accounting, plant and traffic divisions. In the accounting division conference gathered the auditors and accountants and many of the executives of the member companies to hear the papers presented. F. J. Brookman, vice-president of the Rochester Telephone Corp., Rochester, N. Y., presented a paper of plant accounting emphasizing the importance of the accounting as related to the fixed capital accounts of the company and discussed the methods used in the recording of material and distribution of labor costs. V. E. Chaney discussed the value of a handbook for employes which would furnish them with accurate information as to the reports which must be made daily by the workmen. A. C. Cragg then presented the list of units recommended by the accountants in order to establish a definite dividing line between maintenance and depreciation. These units comprise the list of material the replacement of which should be charged through the plant accounts instead of being charged to operating expenses. Resolutions to the general session relative to the approval of these units and the preparation of an accounting handbook were presented and passed by the accounting conference.

In the meeting of the plant division the report of the chairman, A. L. Stadermann, stated that work on some of the major recommendations of last year's meeting had been undertaken under the procedure of the American Engineering Standards Committee. The most important project that has been started is on the simplification and standardization of overhead line material. A beginning has been made on underground conduit material in the standardization of manhole frames and covers. In investigating this subject it was brought out that one foundry company made 140 types of circular frames and covers in addition to many square and rectangular types requiring the carrying of a stock of over 2000 patterns. Another project that is under way is standardization of steel poles, and while the telephone companies are not now interested to any considerable extent, it is well to keep in touch with the work. Standardization of drawings and drafting room practice will recommend itself to plant and engineering employes. Special attention of the plant division just now is being given the subject of inductive co-ordination as well as the closely allied problem of joint pole line construction in which the association is affiliated with the American Committee on Inductive Co-ordination.

W. S. Boyd of Chicago, secretary of the Western Association of Electrical Inspectors, discussed the 1925 revision of the National Electric Code which will soon be ready for distribution. No major changes have been made in the sections relating to wiring for signal and communication lines. Mr. Boyd said that information reaching him indicated an increased interest on the part of telephone companies in the matter of substation protection and expressed the hope that telephone companies would fall into line and so avoid the necessity of securing compliance with the code by municipal order.

R. V. Achatz, of Aurora, Ind., discussed Mr. Boyd's remarks briefly and then presented a series of lantern slides showing drawings of details of joint pole line construction that would meet the requirements of the National Electric Safety Code. These were taken from Bell specifications and illustrate what has been found to be safe practice in this regard. H. E. Gray, plant superintendent of the Home T. and T. Company, of Fort Wayne, then took up the discussion and gave the experience of his company in the extensive rebuilding of its plant. He favored a written agreement on an annual contact rental basis with the number of contact about equal. J. G. Martin of Chicago, a representative of the Middle West Utilities Company, discussed the matter from the standpoint of the power companies bringing out the fact that pub-

lic interest must be considered and predicting that higher distributions voltages would have to be employed in large centers. The discussion of the problems was very general and almost every one in attendance at the conference had a part in it.

At the traffic conference presided over by Chas. C. Deering a very interesting paper on peg counts was presented by R. S. Brewster of the Lincoln T. and T. Company. Methods of taking peg counts both local and toll and the forms used were shown. The system of equating traffic to the standard unit was given. Application of peg count data to the problems of determination of amount of switchboard equipment and of the arrangement of operator's schedules were cited. After a lengthy discussion of the peg count, the attention of the conference was turned to the correspondence course for operators and ways and means of getting it before the operators of the country were discussed.

Directors Are Reelected

Thursday morning President MacKinnon called for the report of the nominating committee. Chairman D. M. Neill presented the following list of nominees for directors: E. C. Blomeyer, Kansas City, Mo.; W. H. Bryant, Mobile, Ala.; C. C. Deering, Des Moines, Ia.; J. B. Edwards, Chicago; H. F. Farwell, Terre Haute, Ind.; W. R. McCanne, Rochester, N. Y.; W. J. Melchers, Owosso, Mich.; T. L. Youmans, Osawatomie, Kan., and J. F. Davies, Spokane, Wash. All of these are retiring directors except Mr. Davies who was selected as a successor of P. S. Pogue of Louisville, Ky. The election was unanimous. A resolution on the death of H. D. Critchfield, long an active figure in the Independent telephone field, was adopted.

The principal address of the morning was made by Samuel O. Dunn, editor of Railway Age, Chicago, who spoke on "The Main Problem of Government Regulation." Mr. Dunn gave as the main problem of railway and utility regulation the question as to whether regulation would permit the necessary net return that will allow adequate expansion and betterment of service. It may be said that the American public recognizes the superior efficiency of private operation but will it so regulate its railways and utilities so that they can continue under private management. Western railways are asking for an increase of 5 per cent in freight rates and the decision in this case and the way it is received by the public will be an indication of what the future will bring.

The recommendations of the accounting conference relative to the list of units to serve as a guide in making a proper distribution between maintenance and depreciation and for the preparation of a handbook were presented by Mr. Cragg and adopted by the convention as a recommended practice. J. Burns of Philadelphia was then introduced. He spoke of the plans for the Sesqui-Centennial Exposition to be held in Philadelphia in 1926 and invited the association to hold its next convention in that city. J. F. Stockwell, executive vice-president of the Keystone Telephone Co., seconded the invitation and spoke of the efforts that are being made to have Independent telephony adequately represented at the Sesqui-Centennial. The meeting adjourned shortly after noon to attend the luncheon of the Independent Pioneer Telephone Association.

Final Session Round-table

The final session on Friday was in the nature of a round-table discussion of the major topics of the convention meetings and some additional matters of interest. Among the topics were adoption of uniform commercial practices for all companies in one state, classification of companies by the Interstate Commerce Commission, and state association activities. Resolutions on the death of B. G. Hubbell and Richard Valentine were adopted.

State Association executives and directors met at luncheon and discussed a program of co-operation between state and national associations and the practicability of carrying the work of the national association along accounting lines down to the smaller companies.

Peddling Aces and Prize Products Hold Big Show

Exhibits at this year's national Independent convention were featured by three developments; a number of marked refinements in the manufacture of equipment and supplies on exhibition, by better showmanship is staging the exhibits and by the constantly increasing number of exhibits pertaining to radio.

One of the attractive exhibit details exhibiting the trend toward handsome displays was in the Monarch layout where L. Q. Trumbull's bright and ablebodied young man Roy Siemund, manager of Monarch's supply department, showed some of the Monarch construction and line supplies set up against a scenic background. It was a "stop, look and listen" display that brought out the sales possibilities of convention showings.

Kellogg put its new 200 type magneto switchboard in the spotlight and found that the new board was one of the great magnets of attention with its operating speed, simplicity and capacity. The Kellogg exhibit was one of the show's greatest. It featured the Kellogg "Service" and "Universal" boards among the standard exchange equipment. Other popular details of the Kellogg display included P. B. X. boards, new enclosed steel sets, and a splendid and complete display of radio apparatus. Kellogg's supply display also was prominently in the picture. Kellogg's staff at the convention included J. B. Edwards, Ben Woodbury, D. J. Gillespie, C. M. Bowling, H. W. Hogue, R. K. Smith, W. R. Kimmel, R. W. Glaser, B. A. Ogden, J. Sidlo, H. A. White, C. A. Reese, H. N. Farris, R. H. Coyne, H. M. Stewart, A. D. Boal, M. A. Bellion, F. A. Bremer, W. S. Green, S. A. Mounteer and Edw. I. Pratt.

Automatic Electric presented two newcomers at this convention. The Type 15 Strowger exchanger for small villages and rural communities made its debut along with the Monophone, a very convenient telephone for home or office use. The full line of Automatic equipment was shown, with an operating demonstration which allowed a valuable close-up study of the interesting details of Strowger operation. An electric-lighted map showing the location of Automatic installations in the U. S. was one of the attractive spots of the display. Those of the Automatic staff who were active around the convention were: Grant Pelton, vice-president; W. F. Benoist, treasurer; T. C. Thompson, general superintendent, and F. Holmstrom, Jr., assistant vice-president; O. V. Dodge, sales manager; R. H. Burfeind, L. A. Cutshall, W. N. Curtis, A. F. Combs, H. E. Conlee (Boston), W. E. Stoffregen (Detroit), A. H. Van Koughnet (Los Angeles), A. C. Stratton, F. J. Truby, W. H. Walter and H. E. Clapham (publicity).

One of the new convention figures was the American Wood Preserver Association, with P. R. Hicks, secretary-manager of the association, in charge, assisted by M. F. Baldwin. The association's men presented in interesting and able fashion the story for creosoted pine poles, cross arms and conduit.

W. C. Meader, secretary of the Bell Lumber Company, always a busy factor at the major conventions, was on the job again at Chicago this year, with the selling tale for Bell poles on tap for the uplift and profit of the interested listeners.

W. S. Ferguson, whose work for Lynton T. Block & Co. has made that company's insurance as generally used as breakfast, dinner and supper by telephone men, was at Chicago, assisted by Charles L. Knox. Block's forms of telephone company insurance were explained by

(*Continued on page* 50.)

Principles of Rate Making

A Thoughtful Study of the Underlying Principles Upon Which Fair Telephone Rate Schedules May Be Based—Paper Presented Before United States Independent Telephone Convention

By R. F. WILDER,

Commercial Superintendent, Tri-State Telephone & Telegraph Co.

In the determination of a schedule of charges for telephone service, there must first be ascertained the necessary revenues to be produced by the application of rates to the existing or anticipated number of services, or quantities of the various classes offered. This amount of revenues is such sum as will, under definite conditions, pay all of the costs of furnishing the service. By "all costs of furnishing the service" there is contemplated:

a. All expense of operation, including an adequate reserve for depreciation so that the integrity of the investment may be preserved and the plant at all times be kept in a condition to render satisfactory service.

b. A reasonable return upon the fair value of the property used, and useful, in rendering telephone service to the public; which return will provide for interest charges on long term debt and other interest bearing obligations, dividends on stock outstanding, and a reasonable addition annually to the surplus account of the company as a safeguard against periods of depression and low earnings, not only in the interest of the utility itself but also to insure adequate service to the public.

The cost of furnishing telephone service is dependent upon certain conditions, and involved in determining what is a proper cost are:

a. An economic arrangement of plant facilities, with a reasonable excess over the amount in actual use, to permit of subscribers' ordinary moves and changes, and to provide for growth on other than a piecemeal plan of construction.

b. An efficient operation of the plant rendering adequate and satisfactory service to the users, without short-sighted economies on the one hand, or undue expense on the other.

c. A rate of return which may be deemed reasonable both from the viewpoint of the investor and the using public so that capital may be attracted to the industry and telephone service continue to be sold.

Duty to Furnish Service to Greatest Possible Number of Users.

It is, without doubt, the duty of a telephone company, as a public service concern, and, I believe, likewise the usual policy, to strive to furnish the best possible telephone service to the greatest possible number of users at such prices as will give to each user at least full value for his payments for service, and at the same time pay the expense of operation and yield a fair return to the company. In such declaration of policy the telephone industry is not assuming a highly virtuous pose, or claiming to operate on a philanthropic or altruistic basis, for only by such policy can it secure the highest development and most widespread use, which in turn will produce the largest possible revenues from the operation of its telephone systems. Each telephone company is engaged in business primarily for the purpose of making money, and, in pursuing a policy of the greatest good to the greatest number, is itself one of the beneficiaries thereof.

Having ascertained the required revenues to be produced from the rates or charges to be determined, and having decided upon a policy of promoting the highest development of use, the next consideration is with regard to the classes of service to be offered. Telephone service first, naturally, divides into two main classes.

1. Local or Exchange Telephone service.

2. Toll or Long Distance Telephone Service.

By "Exchange Service" we refer to telephone communication furnished to and between subscribers within a definite area, usually a municipality and its environs, on a basis of either flat rate charges, or message rate charges, without taking into consideration the time element of the calls made. By "Toll Service" we mean telephonic communication between a subscriber of one exchange area and a subscriber of another more or less distant. It is true that there is no real distinction between the characteristics of the transmission of an exchange call and a toll message; each is the transmission of electric current making possible telephonic communication between two users. Toll service is established as a separate class primarily because of the variance in its use by the subscribers of the exchange area. Exchange service is furnished throughout an area in which it is anticipated, and is usually a fact, there is a widespread demand for inter-communication between the residents of any section of this area and those of any other part; on the other hand the toll service is made use of to a high degree by a very small percentage of the total users of the exchange service and to a very limited extent, or not at all, by the others. Thus, in order that the average user in the exchange area be not obliged to contribute toward the cost of the toll or long distance service of which he makes no, or at least a very limited use, the toll service is established as a separate class and rates assessed on the basis of the units of use and the elements of distance and time consumed.

Classification of Exchange Service.

Exchange service is generally classified in two ways:

a. By character of use.

b. By character or apportionment of facilities.

By use, service is classified as Business, Residence, and Rural.

Business service is that furnished to a subscriber for the purpose of furthering or carrying on his business or profession.

Residence service is furnished for the convenience of the household and the nature of its use is largely social.

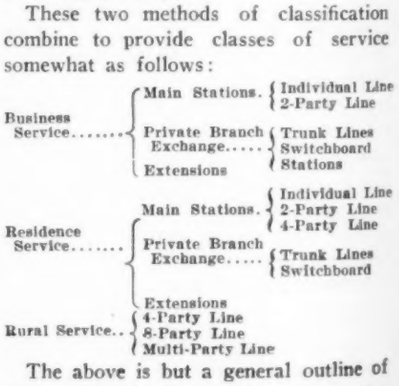
Rural service, with the exception of that furnished to stores, creameries, and other like enterprises, situated in the country districts, is furnished to the farmer and its use is both for business and social purposes.

By character or apportionment of facilities, service is classified as:

a. Main Stations, Private Branch Exchange and Extensions.

b. Individual Line, Two-Party Line, Four-Party Line, etc.

These two methods of classification combine to provide classes of service somewhat as follows:



The above is but a general outline of service classification and is by no means

complete. Further classification is sometimes made by type of equipment; i. e., either wall or desk sets. Rural service is often sub-divided into Business and Residence service.

I believe that telephone companies, generally, are agreed with regard to the determination of the necessary revenue and, therefore, no more space need be devoted in this paper to plant arrangement, economic operation and a reasonable return. I believe also that we are generally in accord on a broad policy to promote development and will all subscribe to classification of service somewhat along the lines mentioned. However, as we approach the problem of assigning a specific rate for each particular class of service, there is some divergency of opinion as to the factors to be taken into account. In the determination of necessary revenues, cost of service, as herein contemplated, with the conditions subsidiary thereto, is the only factor to be considered. In the making of the specific rates, a large majority of telephone operating men will, I believe, hold that, while cost is a factor which must be considered, there is another important factor in the determination of the rates for the various classes of service, namely the value of the service to the user. There are others, however, who contend that cost only should be considered.

Iasmuch as we are discussing the principles of telephone rate making, and not the rate level, or any particular rate, we may forego further reference to toll rates, thus confining the argument to the making of exchange rate schedules.

Common Interest of Public and Company

The telephone company, and the people of the community, have at least one common interest in the schedule of telephone rates to be established for the exchange serving the area. Each desires that the number of subscribers be as large as possible. The telephone company desires this from the standpoint of revenue; the public desires this from its interest in the extent of telephone service to be available. While certain features of furnishing telephone service vary somewhat from the conditions in other lines of industry, for example—it costs more to produce telephone service per station served in a large metropolitan exchange than it does in an exchange serving a small community, at the same time in a given area, service can be furnished more economically, provided there is a high development, rather than a low development of use therein. It is thus possible that, by proper adjustment of rate schedules, the purpose of the telephone company and the wishes of the public served may be fulfilled.

The writer is willing to agree, without further argument, that, if this high development might be attained by spreading the charges for the various classes of service to the users thereof, in strict accordance with the cost of furnishing the service to each, that such procedure woud be highly desirable, but it is my contention that rate schedules so established would not permit the development of use necessary to produce adequate revenues, nor the extent of service to be satisfactory and of proper value to each and every subscriber.

It must be borne in mind that the telephone company and the public served employ different standards in determining what is a satisfactory rate schedule. A satisfactory rate schedule from the standpoint of the telephone company is one which will produce sufficient revenue to cover all the costs of furnishing service, these costs including, as had been said before, the expense and a reasonable return on the fair value of the property. The telephone user has no particular interest in the cost of furnishing the service, but judges the rate schedule solely from the standpoint of whether or not the value of the service to him is worth the charge he pays.

Flat and Measured Rate Schedules

There are two major types of Exchange Rate Schedules, one, "flat rate schedules," under which the various subscribers pay for their respective classes of service, definite monthly, quarterly, or annual charges without limitations as to the number of calls to be made; the other "message rate schedules," under which the users of the various classes of service pay certain minimum monthly charges, which minimum charge includes a definite number of messages, and a per message rate for originating calls in excess of those allowed under the minimum charge. In general, message rate schedules are confined to our very largest cities, and it seems to be a safe policy to pursue to continue to furnish service under flat rate schedules as long as a schedule which will produce the required revenue will continue to permit of a satisfactory development. It should not be overlooked that message rate schedules have two effects upon the furnishing of service that are bound to be felt by the subscribers. First, by reason of the necessity of establishing a count of the originating calls from each subscriber's station, there is additional equipment and additional labor involved which must be compensated for in the telephone rate, and also, the message rate schedule has a tendency to reduce the number of calls made and the subscriber, therefore, under message rate schedules is sure to receive a little less service for the amount he pays than he would under flat rate schedules. I believe this fact has been recognized in some of our largest cities, and while there was a tendency some few years back towards a widespread use of message rate schedules, that tendency has been somewhat modified by the use of mixed schedules, under which business service has been sold at message rates, and residence service at flat rates. In some cases in order to do this it has been found advisable to create zones so as to be able to quote a flat rate within the various zones, and then establish an inter-zone message rate which might be referred to as a local toll charge.

I do not wish to be understood as condemning message rate schedules, for either full message rate schedules, or mixed schedules are absolutely necessary in our largest cities. However, what it is desired to point out is that, while a message rate schedule is presumed to approximate more closely than flat rate schedules, the cost of furnishing the service to the various users, for the reason that the charge to the user varies with the number of calls originated, there is the effect above stated on the cost of furnishing the service, and a certain restriction upon use in each case borne by the subscriber. My contention is that message rate schedules should be introduced as a necessary revenue measure when the exchange reaches such proportions that flat rates will not work out fairly between large and small users of the same class, usually business subscribers, rather than between the separate classes. To illustrate, let us suppose an exchange schedule provides Business Individual Line service at $10.00, Business Two-Party Line at $8.00, Residence Individual Line at $3.75, Residence Two-Party Line at $3.00. The weakness of this schedule to withstand attack as to unfair distribution of charges is not because of the relation between Business and Residence rates, but that the schedule makes telephone service rather expensive for the very small business concern. When a much higher flat rate is necessary, then message rates should be introduced so as to provide for the small business user. It may be suggested that a lower flat rate classification be established—Four-Party Line Business Service. This, however, will not relieve the situation for party line fill cannot ordinarily be secured, and if secured, the service is usually unsatisfactory. The case noted, I believe, is a very good example of rate treatment necessary from the standpoint of the value to the user with very little consideration of cost involved. In my opinion, message rate schedules should never be introduced solely for the purpose of attempting to spread rates in strict accordance with costs.

Basing Rates on "Cost of Service"

It is my understanding that the advocates of establishing rate classifications

entirely on the basis of cost of service have in mind not the cost incurred for each individual user, but for the various classes of users. I believe that the usual plan has been to determine what might be called the average value of the facilities furnished for each user of the respective classes of service and also the average demand upon the exchange for service in originated calls. While, no doubt, the cost of service to the average user of each class can be closely approximated, it should be borne in mind that many of the costs involved in furnishing the service are non-separable costs; that is, they are joint costs which must be apportioned, and even under the best method of apportionment, we are likely to err; for example, in most cost studies in selecting a method of apportioning the costs of collection of revenue, it has been the general practice to apportion on the basis of the amount of revenue collected. This is fairly satisfactory in apportioning collection expense chargeable to exchange service and to toll service, but does not seem to fit the situation in apportioning costs of collection between the various classes of users.

There is no doubt in my mind that the cost of collecting for a business telephone in our largest exchange, as compared with the cost of collecting for a two-party residence telephone, is not in accordance with the revenue involved, which is $10.00 each month for the business individual line telephone, and $3.00 each month for the two-party line residence telephone. On the other hand, if this be apportioned on the number of telephones, there is the same likelihood of error, for it would seem almost absurd to hold that the cost of collecting $300.00 monthly from a private branch exchange subscriber, having some seventy-five stations, would be the equivalent of the cost of collecting for seventy-five main line stations. This is not a reflection upon cost studies, for cost studies are of great value and are indicative of what the spread in rates should be, but, I believe, they are not, and should not be considered conclusive.

In connection with the subscriber's demand for service, as measured by originating calls, in many cases studies will show a much wider variance in this demand between individual users of one class of service than will be found between the average users of two classes. Now, while this variance in demand does affect the cost of furnishing the service to the user, it may have no effect upon the value to him. To illustrate this point, consider the large grocery store with a private branch exchange system, making a very large part of its sales over the telephone. In case of practically all such subscribers, a majority of the trunk lines between the private branch exchange and the central office are arranged for service one way only, incoming to the branch exchange. The value of the telephone service to such a subscriber is by no means determined, or measured, by his originating calls; it is exactly the reverse, and the value to him of his telephone service is largely measured by the number of calls which he receives.

Effect of "Cost of Service" Basis on Rate Schedules

If business and residence rates were established strictly upon a cost basis, I am inclined to believe that at the average exchange the rate for business service would be lower, and those for residence service higher than now in effect. For one reason, the greater part of the business service furnished lies within what we consider the downtown business section of the area, at a short average distance from the central office, whereas the residence service is at a much greater average distance and involves in a case of a single office exchange a much higher average length of subscribers' loop; if in a multi-office exchange, it involves heavy investment in trunk cables, and the additional expense of trunking of a large percentage of the calls. To my mind, it would be unfair to thus penalize the average residence user, because of the greater average distance from the central office to his premises. I believe that when the exchange base rate area is definitely established that each user therein should be treated on a parity with all others without discrimination because of his location within the area. I believe that to do otherwise is just as absurd as if the city government in apportioning the tax burden should levy more heavily for the cost of police protection on the citizen who lives in the outskirts than upon the individual who has his home at a short distance from the central police station. This has no reference to extra-mileage rates for special classes of service furnished beyond the base rate area.

In furnishing telephone service to the community, I am of the opinion that it is of first importance that the service be as widespread as possible, with each user contributing what he can afford to for the service rendered, even though certain classes of users pay slightly more than the actual cost thereof, and certain other classes of users a little less: I have in mind one particular class of service which would be exceedingly difficult to develop under rates established on a cost basis, namely, rural telephone service. Yet rural telephone service, in particular in the small exchange, contributes very largely to the value of the service to the users within the urban area. This is true also with regard to residence service, the residence development being of value to the business users. In this particular I hold that it is more important to the community as a whole that the minimum rate for the party line residence service be such that the citizen in the lower walks of life may have a telephone in his home, than it is that those who are well-to-do may be relieved of the seeming injustice of paying a slight amount more to the telephone company than the exact cost of the service which they receive.

Value of Telephone Service Affects Rates

It should be well considered that the value of telephone service to the user is not measured as is the service rendered by other public utilities. In the use of electric current in my home, the value lies in the convenience afforded to me within my own premises in the use of lighting and heating appliances. The fact of whether or not my neighbors and friends are also users of electric current, neither adds to nor detracts from the value I receive from the electric utility. The same thing may be said with regard to the use of gas, water, etc. On the other hand, the value I receive from my telephone service is not measured by the facilities placed in my home by the telephone company, nor by the telephone company's prompt response to my calls, but by the condition of whether or not others with whom I may wish to communicate by telephone likewise have telephone service.

This condition affecting value of service, peculiar to the telephone, is evidence of the fact that the interest of each subscriber extends beyond consideration of the telephone facilities installed for his use and the price paid therefor, and includes consideration of the rates paid by others. Thus, it will be recognized that while telephone service is sold to the individual, in reality it is a matter of concern to the community as a whole, just as is the matter of the general welfare of the people within the area.

A very large majority of telephone exchanges are operated under flat rate schedules. Under such schedules, classifications of service are largely made by apportionment of facilities. This is accomplished by establishing classes under which one or more subscribers are served from the same circuit, for instance, we have what is known as Individual Line, Two-Party Line, and Four-Party Line Residence Service. The Individual Line, being the highest grade of residence service, naturally, is sold at the highest residence rate; Four-Party Residence Service, being the lowest grade, is sold at the lowest residence rate. Now, for the very reason that classification of residence service is so determined, there enters a factor, which must be considered in establishing the rates for each class, that is very important, not because of its relation to cost of service, but because of its effect upon the value of service to all users. This factor is the character and quality of the exchange service as a

whole. Traffic conditions must be considered and if we have a schedule which induces too large a development of use of party line service, in particular four-party line service, we so degrade the service as a whole that the value to the user is affected. Therefore, in establishing the rate for each of the three classes of residence telephone service, we must establish such differentials as will permit the sale of a reasonable quantity of each class, maintaining such distribution that traffic requirements may be met. The problem is twofold, if the central office equipment is arranged for the furnishing of these three classes of service, we must set up a schedule under which there can be enough sold of each class to warrant the continuation of that classification, but not too great a quantity of the lower grade, or we seriously affect revenue, as well as the quality of the service. To put it briefly, the schedule should be so balanced that each residence user will subscribe for that class of service which will adequately meet his demands for service, as occasioned by his social position in the community. A satisfactory distribution of the users of the various classes of service is one of the most difficult problems in the establishment of telephone rates, and it often has to be accomplished by a more or less arbitrary fixing of the differentials.

With the interest of the public in there being as great as possible a number of users, it is natural that the lowest class of residence service is usually sold at a rate which will not yield as great a return as from the higher grades. As has been said before, this is in the interest of the community as a whole, consequently, as an offset to this, some of the higher grades of service, and some of the special classes, must yield a higher return. In this connection, I believe that it is absolutely right and proper that extension telephone service and all supplemental service be sold at more profitable rates.

Analogy with Newspaper Rates

While definite conclusions may not be reached by analogy, at the same time comparisons are illustrative and indicative. I often think that the spreading of rates for telephone service is somewhat in line with the subscription and advertising rate spread of our newspapers. The newspaper has two kinds of service to sell—news service to its subscribers, and advertising service. The revenues produced from these two services should pay the costs of publishing the paper, including a return upon the investment, and the spread of charges is largely made on an arbitrary basis to induce the largest possible number of subscribers, which makes the advertising service of value. This is comparable to the situation in the telephone field, the greater the number of residence subscribers we can secure the greater is the value of our service to the business institutions in that area. Also there should be considered the fact that the rate for telephone service paid by the householder, with the exception of men of certain professions, is a matter of personal expense, whereas the rates and charges paid by the business users constitutes one of the overhead costs of doing business, which is, in the ultimate, paid by the patrons of the concern.

The history of telephone development, to my mind, well illustrates the importance of consideration being given to the value of the service to the user, or to what may be called his estimate of value, as evidenced by his subscribing for service. Telephone exchanges operated in our cities at first with largely business development, the residence development being limited. Business rates were, in most cases, fully as high for the limited extent of service as are now anywhere charged with the present high development. Residence rates were likewise high, and in relation to the business rates were proportionately higher than generally is the case today.

Lower Rates for Certain Classes Promote Development

When telephone companies began to really cultivate the residence field, in practically all cases the inducement offered to prospective subscribers was a lowered rate for residence service. Under competitive conditons this situation early developed by one of the competing companies reducing its rates for residence service, and expanding its development within the area, usually without the necessity of lowering its business rates. This action necessarily was followed by the other company, and a large residence development stimulated. Of course, in many cases, rate reductions because of competitive conditions were carried to the extreme, but nevertheless there was clearly shown the importance of the value of the service, as placed thereon by the user as a factor in development and the importance to the business user of the residence development secured.

In the early days of our exchanges, the average business house had one telephone line, with the larger concerns having two or three lines and extension stations. Directly following the increase in residence development, business houses added to their telephone facilities, and there followed a rapid development of private branch exchange service. The first effect of the increased residence development was shown by the retail merchant increasing his telephone facilities. Following the use of additional facilities by the retail merchant, the wholesaler and manufacturer soon found it necessary and desirable to increase their telephone service. This period of rapid development was, without doubt, stimulated by competition, but sooner or later came about in the same way in those exchanges that were not competitive, and it does seem that these facts clearly demonstrate that the business user is willing that the rate schedule be so adjusted as to produce a high residence development, and to subscribe for the necessary service for his telephone needs at the rates established in such schedules.

I believe that telephone rate schedules established upon consideration of both cost of service to the operating company, and the value of the service to the various classes of subscribers, will be more satisfactory in the long run, and will produce a greater development and widespread use than will schedules that are established with only the cost factor considered. I believe that the acceptance by the public of rate schedules so established, as evidenced by a steady growth and continued development, is the best possible argument as to the propriety of so fixing telephone rates. I am also of the opinion that it has been through the establishment of rate schedules, determined by mathematical computation, insofar as the total revenue to be secured are concerned, but in which the specific rates were fixed after not only consideration of cost, but by the application of judgment and reason with regard to the value to the user we have brought about in the United States the wonderful development of the telephone.

Jack Coffey Is Making Michigan Take Notice

Grand Rapids.—Affairs of the Southern Michigan Telephone Co. are in far more satisfactory condition than 16 months ago when taken over by the receiver, John W. Coffey. Mr. Coffey predicts that, unless unexpected misfortunes befall the concern, it will be able to show a net surplus of approximately $89,114 for the present year. Of this sum, $53,637 must be used for bonds and for depreciation reserve, leaving $35,477 for cancellation of obligations. Assets of the company at present are estimated at $1,400,000.

Mr. Coffey also is head of a new company recently organized at Sturgis for the manufacture of high-grade upholstered furniture.

Southwestern Breaks Records With September Increase

St. Louis, Mo.—Figures recently released for the 150 cities and towns served by the Southwestern Bell show that the net increase was 2,209 telephones, beating the best previous month of the company's history, September 1924, by 195.

Unit Line in Outside Plant

Fourth Article of a Group Devoted to the Subscriber Line—The Line Is Followed from the Substation Protector Through the Drop and Aerial Cable

By JOHN M. HEATH,
First Lieut., Signal Corps, U. S. Army

14. *General.* The Outside Plant is that part of the plant extending from the subscriber's premises to the arrester frame in the Central Office. Outside Plant is divided into Aerial and Underground, and includes the following:

Drop Wire
Poles and Pole Fixtures
Cable Terminals
Aerial Cables
Junction Boxes
Conduit Runs
Manholes
Laterals
Underground Cable.

15. *Drop Wire.* Leaving the protector of an individual station, we meet a twisted pair of rubber covered, braided, waterproof wire, extending from the protector to the cable terminal. This twisted pair is known as the subscriber's "drop." It is the connecting link between the individuality of the subscriber's telephone and the multiplicity of wires in a telephone cable.

As a drop must sometimes span considerable distances and stand considerable mechanical strain, it must have adequate mechanical strength. Drop wires are usually manufactured of No. 17 steel wire, clad with a jacket of copper; the steel wire provides ample strength, while the copper provides good conductivity. The method of terminating a subscriber's drop is shown in Fig. 8 (TELEPHONE ENGINEER, Sept., 1925, p. 29).

16. *Poles and Pole Fixtures.* A pole line is necessary before there can be any aerial wire and cable. The pole line is the great silent partner to aerial wire and the cable and is a very necessary and valuable part of the outside plant.

For city distribution the high pole line, with many arms, and many wires, is a thing of the past, that form of construction being seen now only on toll lines, and has been replaced in the city with short, stubby poles capable of sustaining the weight of aerial cable and cable terminals. These poles are provided with a few short buck arms or alley arms for running drop wires from the cable terminal to a point opposite the subscriber's premises.

City pole lines are located either on the curb line of the street or in the back alleys, depending upon the particular city. Some cities have no alley system, but where there are alleys this system has decided advantages over street distribution. In the first place it leaves the street free from the unsightliness created by pole lines, and in the second place it brings the drop wires into the rear of the house, as they should be, and facilitates

Fig. 12—Pair Cable Terminal (Unprotected).

mounting the protector in the basement, where it normally belongs.

17. *Cable Terminals.* The cable terminal as its name implies is the terminal of the aerial cable, and is the connecting point between the drop wire and the aerial cable pair. It is a convenient and

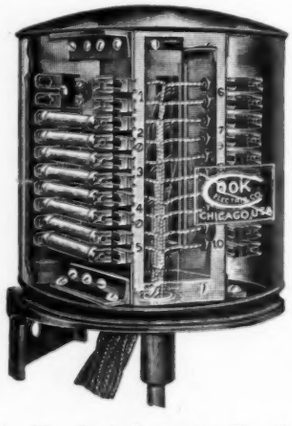


Fig. 13—Cook Protected Terminal.

workmanlike method of terminating cable pairs.

There are two general types of cable terminals. The first, as shown by Fig. 12, has no fuses, and is known as an unprotected terminal. The second, as shown by Fig. 13, is fused, and is known as a protected terminal.

The protection for the first one is provided by fuses at the junction box, and by the protectors at the subscriber's station. The second one is a terminal of a cable that is wholly aerial and consequently has no junction box protection.

These terminals are made complete in the factory and the unprotected types may be provided with a short stub piece of cable for splicing to the aerial cable. The internal connections are made to the binding posts inside of a watertight compartment, and the whole compartment is made moistureproof by a wax compound.

When the stub cable is spliced to the aerial cable the lead sleeve that covers the splice is drawn over the joint and the sleeve sealed at both ends, thus making a neat and watertight joint.

The Unit Line (Figure 1, TELEPHONE ENGINEER, August, 1925, page 24), occupies one pair in the cable terminal. The drop wires are brought in through the holes in the back or bottom, and fastened to the binding posts with lock nuts.

18. *Aerial Cable.* Aerial cable extends along the pole line from the cable terminal to the junction box. Aerial cables are suspended from messengers; a messenger consisting of a number of heavy galvanized steel wires twisted together, thus providing great tensile strength. Attachment of the cable to the messenger is made at frequent intervals, usually by a metal hanger but sometimes by marlin lashings. The messenger is attached to each pole by a substantial clamp bracket. Aerial cable may run directly into the central office, or into a junction box and connect there with an underground cable.

The conductors of an aerial cable are divided into groups terminating at the terminals, each terminal usually having a few pairs on multiple with the next one preceding. For example, in terminating a 25-pair cable into two 15-pair terminals, the first terminal would take conductors 1 to 30, and the second terminal conductors 21 to 50, thus multi-

pling conductors 21 to 30 into both terminals. This is done to provide flexibility for connecting party lines.

Aerial cables are usually manufactured of 22-gauge soft copper wire, paper

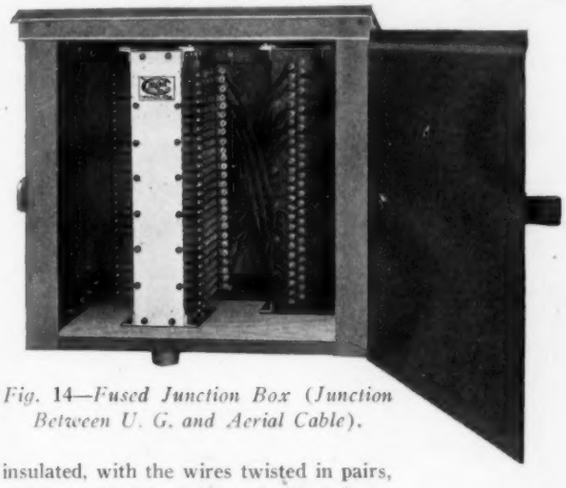


Fig. 14—Fused Junction Box (Junction Between U. G. and Aerial Cable).

insulated, with the wires twisted in pairs, and assembled in layers of spiral form, the spirals having reverse directions. The whole core thus formed is covered with an air and water tight lead sheath. This form of cable has become standard for present day outside use, both aerial and underground.

Our unit line, Figure 1, occupies one pair of conductors in the aerial cable, from the cable terminal to the junction box.

19. *Junction Boxes.* The junction box is placed at the junction between the aerial and the underground cable (see Fig. 14). Their capacity ranges from 200 to 1200 pairs, depending upon the size of the underground cable; 1200 pair cables are usually brought out to two separate junction boxes of 600 pairs each. Junction boxes are always fused to prevent high potential discharges from burning out underground conductors.

A junction box may be mounted on a pole (see Fig. 15), from which radiate aerial cables, or it may be mounted in the basement of a large office or apartment building from whence riser cables run to the various floors.

In the junction box there are uprights, on one side of which is terminated the pairs from the underground cable and on the other side is terminated the pairs from the aerial cable. The fuses are the real junction between the two cables. Terminals, such as shown in Fig. 12, are not fused and work off of the aerial cable coming from a fused junction box.

The unit line, Figure 1, occupies one pair of fuses and conductors going through the junction box.

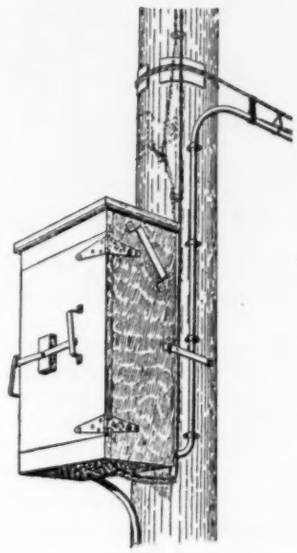


Fig. 15—Junction Box Mounted (Notice Both Aerial and U. G. Cable Entering the Box).

Knapp Made Independent Vets' Chief at Fifth Convention

Chicago, Ill.—Frank A. Knapp of Bellevue, Ohio, was elected president of the Independent Pioneer Telephone Association at the snappy fifth annual meeting of that organization held during the convention of the United States Independent Telephone Association. J. K. Johnston of Indianapolis was re-elected secretary-treasurer.

While the Independents were gathered at Chicago the veterans' organization took in a number of new members. The lively campaign for new members held during the convention was made a rousing affair by the windup of the contest for newcomers which the organization has conducted during the last twelve months. George R. Fuller, the retiring president, won the race "under wraps" with 46 applicants to his credit. Trailing him with 32 applicants, was the debonair Burfeind boy of the Automatic Electric Company. B. A. Ogden of Columbus, Ohio, came along with 15 members for third money and Carl Shearer of Butler, Pa., also got in under the wire. Mr. Fuller, protesting that he had been amply repaid for his work in the Pioneer cause by being elected president, turned the first prize money over to be split among the rest of the prize winners.

The by-laws of the association were amended to make all past presidents of the association members of the executive committee. The executive committee now consists of the president, secretary-treasurer, seven vice-presidents and all past presidents. There are to be not more than 48 vice-presidents. The nominating committee, composed of H. L. Beyer, chairman, George Rodormer, J. G. Ihmsen, E. D. Shade and W. H. Wilson, named the following vice-presidents, who were unanimously elected:

W. H. Bryant, Mobile, Ala.; C. A. Rolfe, Redlands, Calif.; W. G. Brorein, Tampa, Fla.; Otto Wettstein, Jr., Orlando, Fla.; H. D. Currier, Chicago; Frank L. Eldridge, Chicago; J. B. Edwards, Chicago; E. D. Glandon, Pittsfield, Ill.; John W. Coffey, Indianapolis, Ind.; Frank V. Newman, La Porte, Ind.; C. C. Deering, Des Moines, Iowa; John A. Gustafson, Fredonia, Kans.; L. M. Kraege, Topeka, Kans.; H. B. Smith, Ashland, Ky.; J. B. Lockwood, Muskegon, Mich.; P. M. Ferguson, Mankato, Minn.; D. M. Neill, Red Wing, Minn.; Houck McHenry, Jefferson City, Mo.; R. E. Mattison, Lincoln, Neb.; W. R. McCanne, Rochester, N. Y.; Geo. W. Rodormer, Chicago.

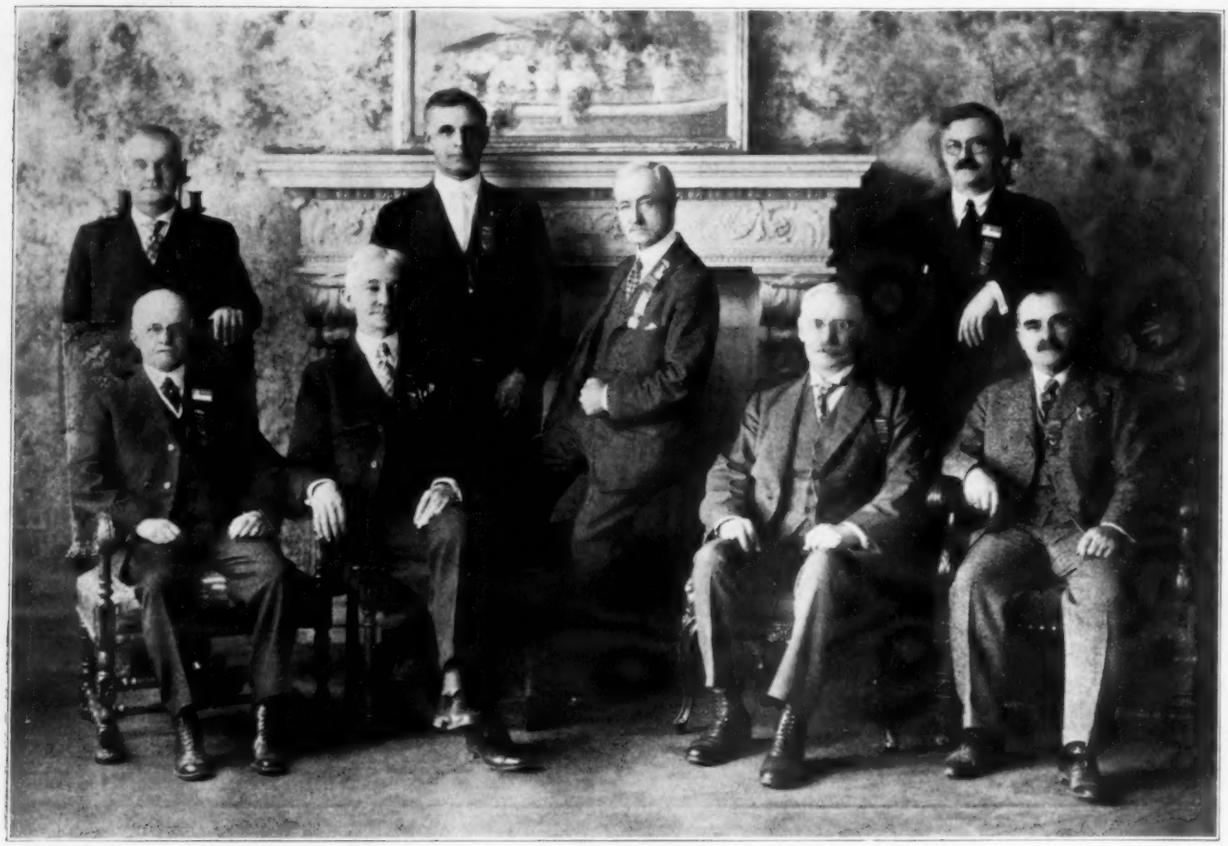
J. G. Ihmsen, Albany, N. Y.; John H. Wright, Jamestown, N. Y.; J. F. Hayden, High Point, N. C.; Frank L. Beam, Mt. Vernon, Ohio; Conrad Kipp, Greenville, Ohio; Frank L. McKinney, Columbus, Ohio; E. J. Boase, Frederick, Okla.; Chas. E. Wells, Hillsboro, Ore.; E. D. Schade, Johnstown, Pa.; W. H. Wilson, Clearfield, Pa.; H. C. Tucker, Sumter, S. C.; W. G. Bickelhaupt, Aberdeen, S. D.; Jas. N. Cox, Cookesville, Tenn.; J. C. Duncan, Knoxville, Tenn.; W. M McAnge, Jr., Bristol, Tenn.; R. W. Garner Waco, Texas; R. B. Still, Tyler, Texas; C. L. Ovitt, Enosburg Falls, Vt.; Rodney M. Coggin, Warsaw, Va.; F. B MacKinnon, Chicago; W. F. Goodrich. LaCrosse, Wis.; and W. L. Smith, Neillsville, Wis.

Past presidents who were made ex-officio members of the executive committee are H. F. Farwell, H. L. Beyer, H. E. Bradley and Geo. R. Fuller.

During the year, up to convention time, 168 new Pioneers "joined up."

Pioneers and their friends at the convention were the guests of a number of the foremost manufacturing and engineering factors at a big luncheon and dance. George Rodormer, Frank Eldridge, John Jaap, O. V. Dodge, Carl Schaffer and E. I. Pratt engineered the merry affair. Dorothy Paca, the talented daughter of W. S. Paca, provided some high spots of entertainment with several vocal numbers.

These Independents Have Forty Year Records



Seated, Left to Right: W. S. Paca, F. C. Middleton, Wm. Hubbard, Francis Dagger, P. K. Higgins. Standing, Left to Right: J. H. Thompson, H. A. Rowe, W. H. Wilson.

WILLIAM S. PACA, secretary and general manager of the Petroleum Telephone Co. of Oil City, Pa., was born in Baltimore, Md., August 27, 1863, and entered the employ of the Baltimore, Md., Exchange Co. in 1882, serving as night telephone operator, switchboard installer and wire chief. He entered the Independent telephone field at Baltimore in 1893 and has been identified with the telephone industry for over 43 years. Mr. Paca later served as construction engineer for Independent plants at Baltimore, Cleveland, Pittsburgh, Jersey City, Newark, Trenton, Erie and many smaller cities. Mr. Paca also served with the first electric railway that hauled passengers in this country, located at Baltimore, Md. He also conducted experiments in long distance telephony over the Postal telegraph wires in 1884, before the Bell Co. had any long distance lines. Mr. Paca is a great-great-grandson of William Paca, a signer of the Declaration of Independence.

F. L. MIDDLETON has been identified with the telephone industry for over forty-two years, starting as messenger boy and night operator at Elkhart, Ind., in 1883. Mr. Middleton remained with the Bell in various capacities and at various points until the opening of the Independent field. He then assisted in the organization and construction of the exchanges at Elkhart and Goshen, Ind., and later assumed the management of the Merchants' Mutual Telephone Co. at Michigan City, Ind., after which he assisted in the organization and construction of the exchanges at Waco and Clifton, Tex., and for a period of perhaps two years was manager at Waco. At this point in his career he entered the manufacturing field where he served for many years in executive capacities, spending most of the period with the Stromberg-Carlson Telephone Manufacturing Co., The International Telephone Manufacturing Co., The Automatic Electric Co., and the North Electric Co. He then returned to the operating field, serving four or five years with the Pioneer Telephone Co. of Oklahoma and with the Texas Telephone Co. at Waco; in both instances as traveling superintendent. After which he assumed the management of a group of exchanges for the Southern Michigan Telephone Co., with headquarters at Coldwater, Mich., at which point he still maintains his residence. He spent some four or five years with the Southern Michigan, resigning to accept an offer from the American Electric Co., of Chicago, to act as its special representative, which position he now holds. His hobby is radio.

WILLIAM HUBBARD, now in his 76th year, qualifies fully as a telephone pioneer. Records show that Mr. Hubbard was the first Independent manufacturer of acoustic telephones which he made at Elgin, Ill., in 1878. Mr. Hubbard was born and reared at Elgin. He first became interested in telegraphy in 1864, and served as the first telegraph operator at Greeley, Colo., in 1870. In 1879, 1880 he was the first Independent dealer in telephones in the city of Chicago. He also was the first manager of the Chicago-Bell Telephone Co. at Elgin, Ill., starting in August or September 1881 with an office in his own building and serving as manager there for eight years. He solicited and got the right of way for the first toll line between Chicago and Elgin, was in the Independent telephone business for over ten years, and was the only exhibitor of electric telephones "sold outright" at the World's Fair in Chicago, these instruments being imported. He also had an exhibit at the

World's Fair at St. Louis, at which he demonstrated the evolution of the telephone. This exhibit afterward was purchased by Purdue University, and still forms a part of the permanent display of that institution. Mr. Hubbard built the first Independent telephone exchange for the Citizens' Telephone Co. at Marengo and Woodstock, Ill., using the Gilliland magneto instruments. (The Illinois Bell Telephone Co. to this day continues paying a royalty to the Citizens' Co. on the business done in Marengo.) Mr. Hubbard built the first Independent telephone exchange at Dawson, Ga., and constructed the first Independent telephone line in Michigan. In his day he also was a prominent exporter of Elgin acoustic telephones, having many customers in England, Sweden and other foreign countries in addition to his trade throughout the United States. The first Strowger Automatic Switchboard was installed by Mr. Hubbard for the United States Government at Fort Sheridan, Ill., in October 1892. He sold the first Independent telephone exchange for the Stromberg-Carlson Co. at Marseilles, Ill. In 1889-1900 Mr. Hubbard installed telephones for the Independent company at Atlanta, Ga., and in the latter year also supervised the installation of a Stromberg-Carlson system at Savannah, Ga. Mr. Hubbard still retains an office at 49 Hubbard Bldg., Elgin, Ill., but his home address is Box 85, Hubbard Woods, Ill.

FRANCIS DAGGER, 1554 Yonge st., Toronto, Ont., Can., was born at Liverpool, England, June 3, 1865. Before entering the telephone service he had been three times around Cape Horn, once around the Cape of Good Hope, once around the world and six times across the Equator as an apprentice on a 700-ton sailing ship. Shortsightedness proving a barrier to a seafaring career, he turned to telephony which was just being introduced in Great Britain, and in 1881 entered the service of The Lancashire & Cheshire Telephonic Exchange Co. at Wigan, assisting in the installation of the first system in that town, subsequently serving as electrician at Burnley, Blackburn and Preston. In 1885 he entered the head office of The Western Counties & South Wales Telephone Co. at Bristol, being later manager of the Devon and Cornwall district of that company. From 1893 to 1899 he was Chief Inspector in charge of Construction and Maintenance in the cities of Birmingham and Sheffield for the National Telephone Co. He came to Canada in 1899 and, after a year with The Bell Telephone Co., made a special study of telephone conditions on the North American continent with a view to determining the relative merits of public ownership, private monopoly, and competition. He prepared a report for Sir William Mulock, then Postmaster-General of Canada, upon this subject in 1903, which resulted in the appointment of a Parliamentary Select Committee to inquire into and report regarding the various telephone systems in operation in Canada and elsewhere, 1905. Was appointed to assist and advise this committee during its inquiry. Conducted an educational campaign for the Manitoba Government, preliminary to taking a vote of the people upon the question of the public ownership of the telephone service, 1906. Was commissioned by Government of Saskatchewan to investigate and submit recommendations enabling that government to enact legislation for the public ownership of local exchanges and long distance lines, and to assist rural communities to establish farmers' telephone systems, 1907-8. The withdrawal of The Bell Telephone Co. from the three prairie provinces was largely due to the activity and energy of Mr. Dagger. He drafted the Ontario Telephone Act, 1910, and acted in an advisory capacity to the Ontario Railway and Municipal Board which has jurisdiction over about 650 telephone systems in that province, being later appointed Supervisor of Telephone Systems, which position he now holds. Mr. Dagger has been actively identified with the Independent telephone movement since its inception, being Honorary President of the Canadian Independent Telephone Association. He has published numerous articles upon telephone questions and has contributed papers to the National Independent Telephone conventions and various state conventions. He also has acted for the cities of Toronto and Montreal in connection with rate applications of The Bell Telephone Co. of Canada to the Board of Railway Commissioners for Canada in 1910, 1911, 1919 and 1921.

P. KERR HIGGINS is a "canny Scot," having started in the business 45 years ago in Glasgow, Scotland, as telegraph messenger boy. A year later he transferred his affections to the telephone industry, beginning as "boy operator" with the National Telephone Co. His promotion was rapid and steady and in nine years he was chief test clerk for Scotland. He then sailed "round the horn," arriving in Chile, South America, just in time for the revolution, during which he had some thrilling experiences. He was chief electrician and during that period, among other things, installed the first exchange at Triaguen, high up in the Andes, and also installed the first "long line" in the Andes. After three years he set sail for the U. S. A., being employed by the Central Union Telephone Co. as cable tester, repair man and finally chief inspector. Since then, among others, he has filled the following positions: Equipment superintendent, Home Telephone Co., Los Angeles (first automatic plants installed on the Pacific Coast): general manager, U. S. L. D. Tele. Co., Southern California; general superintendent, Pioneer Telephone Co., Oklahoma, and general manager, Texas Independent Telephone System. At the present time he is president and general manager of the Telephone Service Bureau, St. Louis, Mo., operating extensive and valuable telephone properties in Missouri Oklahoma and Texas.

J. H. THOMPSON, general manager of the Valley Telephone Co. at Lebanon, Ohio, started with the Cincinnati and Suburban Telephone Co. in 1879. He later served as repair man with the American Union Telegraph Co., the Western Union Telegraph Co. and the B. & O. Telegraph Co. He constructed Independent telephone plants at various points and for 22 years engaged in construction work in Mexico, Central America and South America. He has been with the Valley Telephone Co., 1914 and 1915 and from 1921 to the present time at Lebanon, Ohio, where he was born.

HERBERT A. ROWE, superintendent of the Home Telephone Co. of Elkhart, Indiana, began his telephone career with the B. & O. Telephone Co. in that city in 1885. This was a solid, 3-wire, copper plant said to be the first telephone plant constructed in the United States. A Mr. Banfield was its engineer. Mr. Rowe has served continuously with the Elkhart plant for forty years.

W. H. WILSON, of Clearfield, Pa., was born at York, Pa., May 13, 1860. He entered the employ of the Telephone Exchange Co., now the Chesapeake & Potomac Telephone Co., at Baltimore, Md., in September, 1879, serving as switchboard operator. The exchange then was composed of 35 lines and approximately 100 telephones. Box telephones, used for both subscribers and operators, had neither receiver nor transmitter. After serving as chief operator, trouble man, installer, wire chief, superintendent of equipment and exchange manager, Mr. Wilson left the Bell Co. in 1897 to become superintendent of construction for the Newark (N. J.) Telephone Co., and at Sing Sing, N. Y., installed the first common battery board in the country. In 1899 Mr. Wilson was manager of the Home Telephone Co. at Baltimore; in 1901 was superintendent and general manager of the Union Telephone Co., Erie, Pa., and in 1907 became general superintendent of the American Union Telephone Co. of Harrisburg and Philadelphia, Pa. In 1912 he returned to Erie as general manager of the Union Telephone Co., and since 1920 has served as general manager of the Huntingdon & Clearfield Telephone Co. Mrs. Wilson also was in the telephone business.

Testing and Fault Location

Methods Employed Are Described—Making a Varley Loop Test—How the Murray Loop Test Is Made—Locating Split Pairs in Cables—Testing Formulae

By P. KERR HIGGINS

The writer had great pleasure in meeting a number of the readers of TELEPHONE ENGINEER at the recent convention in Chicago and in course of conversation with some of them it developed that the theory of electrical current as applied to the Wheatstone bridge was not always understood. Hence, a brief additional explanation of this subject will be given here before entering into a discussion of various tests which are especially adapted to bridge work.

The flow of an electric current through or over a conductor may be compared to the flow of water through a pipe. Just as the current of water is stronger as the water level is increased in the tank or reservoir so is the current of electricity stronger if the electrical pressure or voltage is increased. So also the less the resistance of the conductor, the stronger will be the electric current, just as the current of water is stronger when a larger pipe is used. The rate of water flow in a pipe is expressed in gallons as follows:

$$\text{Gallons per second} = \frac{\text{pressure of water}}{\text{resistance of pipe}}$$

Likewise the rate of electric current is expressed thus:

$$\text{Amperes per second} = \frac{\text{pressure (EMF) of battery}}{\text{resistance of conductor}}$$

Or as used in Ohm's law:

$$C = \frac{E}{R}$$

Where

C equals current in amperes
E equals voltage in volts
R equals resistance in ohms

If we desire to find the rate of current flow in a simple electrical circuit, assuming the values as follows, voltage 24 volts, resistance 200 ohms, then

$$C = \frac{24}{200} = .12 \text{ amperes}$$

The flow of an electric current through two parallel conductors or resistances may be considered as follows: Suppose two equal resistances are connected across the poles of a battery in what is commonly known as a parallel connection and assume that the connecting wires have no resistance. Since the two resistances are equal, it may be expected that both circuits will carry equal current in a similar manner that two exactly similar water pipes will carry exactly equal amounts of water. When the two resistances are not equal, then each will carry an amount of current inversely proportional to its resistance. The total conducting path of such an arrangement is the sum of the conducting values of the individual resistances. If K stands for the total conducting value of the current and K_1 for one path and K_2 for the other, then the relation would be written thus: $K = K_1$ plus K_2. The conducting value of a circuit is exactly opposite to its resistance, for the greater the resistance the less the current with the same voltage or pressure. We may therefore write this statement that conductivity is the reverse of resistance by the following formula:

$$\text{Conductivity} = \frac{1}{\text{resistance}}$$

When we say that conductivity of a circuit is the reciprocal of its resistance, we mean that if a wire has a resistance of ten ohms, its conductivity is $\frac{1}{10}$ (conductivity of one ohm being 1). If it were 3/5 of an ohm then its conductivity would be $\frac{5}{3}$. Now if more than one path is open to the flow of the current, it is apparent that the combined or joint resistance of that circuit will be less than the resistance of either of the paths. To obtain the combined resistance, we find the sum of the conductivities of the various parts and the combined resistance will be the reciprocal of the result obtained. For example: Find the combined resistance of a circuit with two paths for the current offering respectively 5 and 3 ohms. The joint conductivity will be

$$\frac{1}{5} + \frac{1}{3} = \frac{5+3}{15} = \frac{8}{15}$$

and the joint resistance would be

$$\frac{15}{8} = 1\tfrac{7}{8}$$

A knowledge of these fundamental rules is necessary in order to appreciate and understand the purpose and use of shunts in connection with galvanometer work.

Slide Wire Bridge

This bridge has a tightly stretched wire in place of the two ratio arms as shown in Fig. 1. In this case the ratios are varied instead of the rheostat as in the Wheatstone bridge. A sliding contact is connected to the receiver and allows a very fine adjustment to be made. When a balance has been obtained, all noise is shut out of the receiver. While a standard slide wire bridge is on the market, a very convenient and cheap arrangement can be made by using an ordinary yard stick, a few cells of dry battery, a piece of German silver resistance wire and an ordinary telephone receiver. The German silver resistance should be stretched over the entire length of the yard stick. If the arrangement is made up as shown in

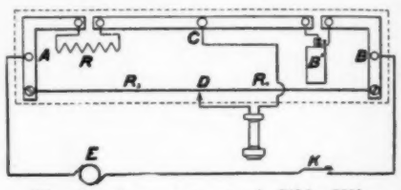


Fig. 1—Arrangement of Slide Wire Bridge.

Fig. 1, the resistance of the coil, R_1 should be about 1 ohm and the conducting strips should be made of heavy low resistance material with binding posts as shown in diagram.

In the standard slide wire bridge, the arms A and B of the bridge are united in one straight resistance wire. Along this wire a point slides as a movable contact. The functions of the parts of the regular bridge are reversed, in that the rheostat R has a fixed value while the arms AB are adjustable. The continuous wire forming these arms is generally furnished with a scale divided into 1000 parts. Then since AB equals 1000, the ratio

$$\frac{A}{B} = \frac{A}{1000 - A}$$

and the unknown resistance

$$X = \frac{A}{1000 - A} R$$

It is customary to make the bridge wire forming the arms AB one meter in length. For the sake of portability this is divided into several shorter lengths, connected in series by metal blocks of practically no resistance. If desired, the scale may be calibrated directly in ohms, making the instrument an ohmmeter (see Fig. 2).

Another variation from the straight

wire of the slide wire bridge is made by using a toroidally wound coil of resistance wire, forming a ring about six inches in diameter, with a rotary arm

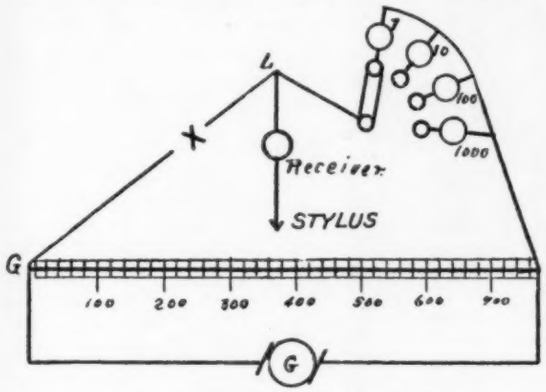


Fig. 2—Ohm Meter or Fault Finder, Using Hand or Power Generator.

pivoted in its center. This arrangement is substantially the same as with a straight wire.

To make a Varley loop test with this type of bridge it will be necessary to interchange the battery and receiver so that the batteries may be connected to the stylus or pointer (movable contact). This brings the battery in the ground circuit instead of the receiver which might be affected by earth current. Fig. 3 shows this arrangement. The standard resistance R should be low if the line is short. To make this test close the switch to the point leading to the bridge. Place the stylus on slide wire AB and then tap the receiver key (K). If a click is noticed move the stylus and try again. Do not close the receiver key and tap the stylus as this may give a wrong result. When balance is obtained read a and b and compute the loop resistance using the following equation:

$$\text{Loop resistance} = R' = \frac{Rb}{a}$$

Now change switch to the ground and balance again, using the following formula with the new values:

$$X = \frac{aR_1 - bR''}{a + b}$$

The point of balance must not be near either end of slide wire to obtain accurate results.

Loop Tests.

Loop tests referred to in the preceding paragraph are so called because the bad wire is always connected at the distant end with the good wire in order to form a loop. This loop is divided into two parts by the fault. There are two principal loop tests which are made use of in the operation of the Wheatstone bridge.

The Murray Loop.—The theoretical diagram of this loop test is shown in Fig. 4, while the detail arrangement of this test is shown in Fig. 5. In the Murray loop arrangement, the two parts of the loop are two arms of the Wheatstone bridge, the two other arms of which are made up in the testing apparatus. In the arrangement shown in Fig. 4 fj is the bad wire and ej is the good wire used to form the loop. F is the point at which the trouble exists, which in this instance is shown to be a ground. One terminal of the battery is grounded at the junction of the bridge arms and through the earth the battery connection is completed to the point F. Now calling a the resistance between f and F and r the total resistance of the loop we have the following relation:

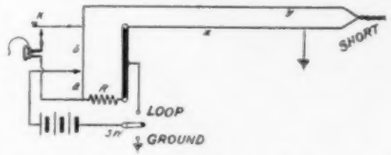


Fig. 3—Arrangement for Varley Loop Test.

$$\frac{B}{R} = \frac{r - a}{a} \quad \text{and} \quad a = \frac{Rr}{B + R}$$

From the last equation, the distance to the trouble may be easily calculated when

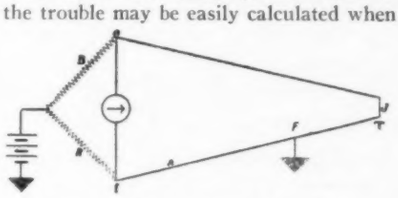


Fig. 4—The Murray Loop Test.

the values of B and R and the resistances per unit length of the loop wires are known. Now since the resistance in uniform wires is proportional to the length, these equations may be set up as follows if the wire of the loop is of one size.

$$\frac{B}{R} = \frac{L - d}{d} \quad \text{and} \quad d = \frac{RL}{B + R}$$

In this case L is the total length of the loop and d is the distance to the fault. In using the formula shown (a) in order to calculate the distance to the fault, the resistance of the wire per 1000 feet must be determined from a wire table. (See Fig. 6.) Any variation from gauge or a difference of temperature from that assumed will frequently cause errors. However, these errors are very largely eliminated when the distance to the trouble is determined as a fraction of the length of the loop. The use of this loop test with a slide wire bridge is shown in Fig. 7. In order to apply the Murray loop test, it is necessary to have a wheatstone bridge adapted for this use. In Fig. 8 is shown the bridge detail of a Queen Acme test set so equipped. In this set the change of arrangement is accomplished by altering the position of the plugs, in lower left hand corner of set. When plugs are in hole marked M the bridge stands arranged for Murray balance. When in lower hole the bridge stands arranged for the Varley loop test or for the measurement of resistance. In using the bridge for the Murray test, the commutator ARBX should be set as shown by the arrow in Fig. 8. Remove 1000 ohms from B arm allowing A arm to be entirely plugged up. Run a wire from post mark G to ground or cable sheathing, if cable sheathing is not grounded. The following test is useful only in case one wire of a pair of conductors is in trouble, as in this case we have one good wire and one bad one. Both of these wires must be exactly the same length; otherwise the test will not be accurate. This arrangement will give a circuit as shown in Fig. 9. When needle of galvanometer gives no deflection after removal of proper plugs in the variable re-

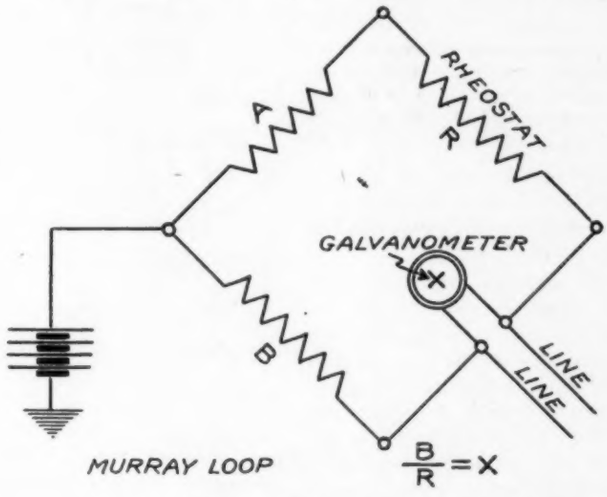


Fig. 5—Murray Loop Detail and Formula.

COPPER WIRE TABLE.

No. B.&S.	Ohms Per Foot.	Ohms Per Mile.	Feet Per Ohm.	Weight Per Foot.	Weight Per Mile.	Feet Per Pound.	Diameter in Mils.	Circumference in Cir. Mils.
5	.0003074	1.6889	3253.09	.1	529	9.98	182.	33124.
6	.0003879	2.1295	2577.981	.079	419	12.58	162.	26244.
7	.000491	2.6850	2036.65	.063	331	15.87	144.	20736.
8	.0006214	3.3859	1609.27	.05	262	20.01	128.	16384.
9	.0007834	4.2769	1275.082	.039	208	25.23	114.	12996.
10	.0009785	5.3848	1021.972	.032	166	31.82	102.	10404.
11	.001229	6.7869	813.661	.025	132	40.12	91.	8281.
12	.001552	8.5633	644.323	.02	105	50.59	81.	6561.
13	.001964	10.794	560.08	.0157	83	63.79	72.	5184.
14	.002485	13.612	402.414	.0124	65	80.44	64.	4096.
15	.003133	17.165	319.179	.0098	52	101.4	57.	3249.
16	.003914	21.646	255.55	.0079	42	127.9	51.	2601.
17	.005028	27.294	196.732	.0061	32	161.3	45.	2025.
18	.006363	34.416	157.014	.0048	25.6	203.4	40.	1600.
19	.007855	43.400	127.051	.0039	20.1	256.5	36.	1296.
20	.009942	54.749	100.582	.0031	16.4	323.4	32.	1024.

Fig. 6.

sistance arm, we will have the following formula:

B:R::ax:bx or B (bx)=R (ax). Since L=total length of wire=twice length of wire in cable, ax=L−bx, and B=1000, we have 1000 bx=R (L−bx) or $bx=\frac{RL}{1000+R}$.

This formula indicates the distance to trouble and may be found as follows: Multiply resistance unplugged in resistance arm necessary to bring galvanometer to balance by twice the length of cable in feet. Divide the result by the sum of 1000 and the unplugged resistance. In making the Murray test, it is not necessary to know the resistance of the wire, but we must know the distance from the testing point to the point where the good and bad wires are looped together. As this test is generally used for locating grounds in cables, it is necessary to have the exact number of feet from the test set to the cable end. Any error in the length of the cable or wire under test will cause an error in the location of the fault. To make this test it is absolutely necessary to have one good wire and by looping this good wire to the various bad wires desired to be tested, the trouble on each can be located. It is assumed that the entire loop is of the same sized wire throughout. When a test is made on a loop which is made up of various size conductors, this formula will not hold good.

If a loop is made of several lengths of conductors of different cross sections, the distance to the fault is easily calculated by expressing the different cross sections in terms of equivalent length of one of the conductors forming the loop. For example, if a No. 12 NBS hard drawn copper wire was used in conjunction with a No. 22 gauge cable wire, then we would reduce the No. 12 wire to an equivalent length of No. 22 gauge wire. If the loop is made up of several lengths of conductors of different sectional areas as often occurs when cable circuits are

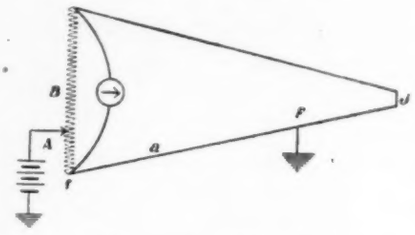


Fig. 7—Murray Loop Test With Slide-wire Bridge.

joined to toll circuits, the distance to the trouble is calculated by expressing the different cross sections in terms of equivalent length of one of the conductors in the loop. To do this the cross

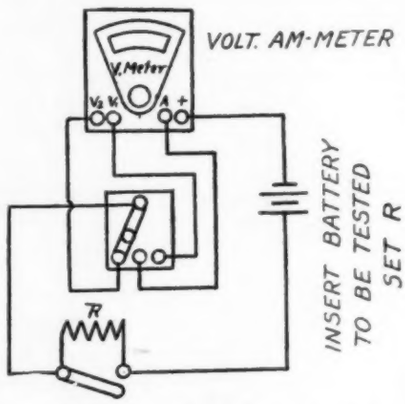


Fig. 8—Bridge Detail for Locating Ground.

sections and the lengths of the different sections must be known. The reduction is made by multiplying the length of each conductor by its resistance per thousand feet and dividing the product by the rated resistance per thousand feet of the size of the conductor to which it is being reduced.

Great care should be taken to see that the connections at the far end where the wires are looped together are tightly made and clean, as any corrosion or resistance at that point will cause inaccuracies. If the trouble is in a cable multipled into two or more branches, the first location should be made with the wires looped at the furthest end from the instrument as measured along the cable. If the trouble is in one of the multiples, the location in this case will appear to be at the point where the multiple cable taps the main cable. This does not mean that this is the proper location, but merely indicates that the trouble is in the multiple branch cable connected at that point. It is then necessary to repeat the test forming a loop at the distant end of the branch cable in which the trouble is shown to be. This last test should give the exact location of the trouble. If all the wires in a cable are grounded as is frequently the case when the lead sheath is broken and water is permitted to enter the cable it is necessary to have an outside wire which should be well insulated and free of grounds. Care must be taken to see that proper allowance is made for the lead wires from the test set to the line actually under test. It is of course preferable that these be of the same gauge as the cable under test when it may be considered as part of the cable.

The Varley Loop

This arrangement differs from the Murray loop in that a portion of the loop is made up of resistance in the test set as shown in Fig. 10. This loop test can be usefully applied in types of Wheatstone bridges which permit of making the ratio A to B unity, or 10, 100, 1000, etc. In such cases the ratio of A to B is fixed and R is varied until a balance is obtained. Now, calling the resistance of the bad wire fj plus that of the wire ej, r, and the resistance from f to the fault a, we have the following formula:

$$\frac{A}{B}=\frac{r-a}{R+a} \text{ and } a=\frac{Br-AR}{A+B}$$

This formula may be expressed in another way which in some cases is more satisfactory, called the ratio $\frac{A}{B}=D$.

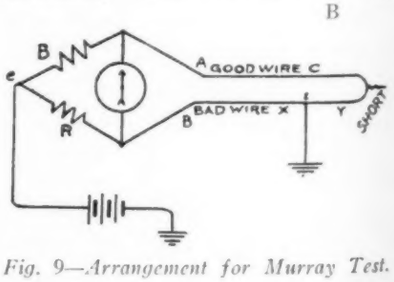


Fig. 9—Arrangement for Murray Test.

Service cannot stop

The telephone, like the human heart, must repair itself while it works. The telephone system never rests, yet the ramifications of its wires, the reach of its cables and the terminals on its switchboards must ever increase. Like an airplane that has started on a journey across the sea, the telephone must repair and extend itself while work is going on.

To cut communication for a single moment would interrupt the endless stream of calls and jeopardize the well-being and safety of the community. The doctor or police must be called. Fire may break out. Numberless important business and social arrangements must be made.

Even when a new exchange is built and put into use, service is not interrupted. Conversations started through the old are cut over and finished through the new, the talkers unconscious that growth has taken place while the service continues.

Since 1880 the Bell System has grown from 31 thousand to 16 million stations, while talking was going on. In the last five years, additions costing a billion dollars have been made to the system, without interrupting the service.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES
BELL SYSTEM
One Policy, One System, Universal Service

Then

$$D=\frac{r-a}{R+a} \text{ and } a=\frac{r-DR}{D+1}$$

For the ratio unity this becomes:

$$a=\frac{r-R}{2} \text{ or } R=r-2a$$

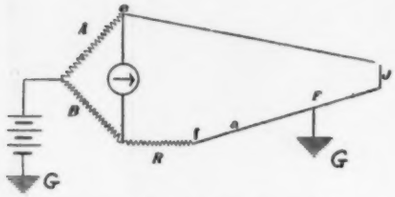


Fig. 10—The Varley Loop Test.

This formula holds good provided the wires of the loop are of the same cross section throughout. The distance from the fault may be taken from one of two ways: First, if the line is of uniform resistance, and known length, the distance d to the fault from J is $d=\frac{R}{r}L$. In this case L is the length of the cable and equals half length of the loop and r is total resistance of loop. Second, if the gauge of the wire is known, but not the length, the distance d to the fault from j is

$$d=R \times \frac{\text{feet per ohm of circuit from J to fault}}{2}$$

The following rule may be easily remembered: Divide the resistance unplugged in the rheostat by two; the result will be the resistance from the fault to the distant end. By dividing this result by the resistance per mile of wire we get the distance from the fault to the distant end.

Locating Split Pairs in Cables

This fault is frequently encountered in telephone cables and goes under the name of an inductive cross. This fault may be due to careless cable splicing. Telephone cables are made up of twisted pairs and when splicing is done, no attempt is made to connect the pairs in any definite order. As a matter of fact many splicers mix the pairs purposely in an effort to make the capacity of the twisted pair more uniform. In Fig. 11 an attempt is made to show how such a mistake might be made. C and F are straight, D and E are cross connected. If two pairs are spliced in such a manner that the wires of the pair on one side of the splice are connected to one wire of each of the two pairs on the other side of the splice, an inductive cross will be the result, or in other words, bad cross talk will exist between the two pairs unless the cable is a very short one. In Fig. 12 is shown the method of locating an inductive cross of this kind by means of the Wheatstone bridge, using the receiver instead of the customary galvanometer and a source of alternating current instead of the usual direct current. In order to make this test, a good cable pair is necessary. The connections required in this test are the same as those for the Murray loop test. Connections are made, first, as shown in Fig 12 and the rheostat (R) adjusted until a balance has been found or no sound is heard in the receiver. We now change the ground connections as shown in Fig. 13. These ground connections

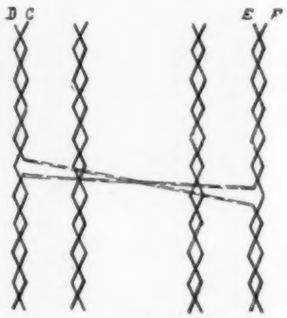


Fig. 11—Splicing Fault.

may be made either at the far end of the cable as shown at B or they may be made at the office end of the cable as shown at C, Fig. 13, by dotted lines, the value R being found as in the first test. The formula used for this purpose is as follows:

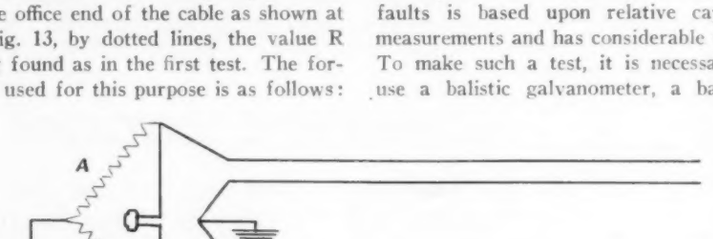


Fig. 12—Locating Inductive Cross.

K = capacity per unit length between two wires of a good pair.
K′ = capacity per unit length between one wire if one faulty pair and one wire of other faulty pair.
R = resistance in rheostat to balance.
A = resistance in bridge arm A.
x = distance to cross.
a = length of pair of wires.
Then

$$\frac{R}{A}=\frac{Ka}{Kx+K'(a-x)}$$

and

$$\frac{R'}{A'}=\frac{Ka}{K(a-x)+K'x}$$

From the second equation

$$K'=\frac{K(A'a-R'a+R'x)}{R'x}$$

Substituting this value for K in the first equation and solving for x:

$$\frac{R}{A}=\frac{Ka}{Kx+\dfrac{K(A'a-R'a+R'x)(a-x)}{R'x}}$$

$$x=\frac{a\dfrac{R'-A'}{R'}}{1-\left(\dfrac{A}{R}-\dfrac{R'-A'}{R'}\right)}=\frac{aR(R'-A')}{2RR'-AR'-A'R}$$

This is a very common fault and frequently neglected because of the difficulty of actually locating same. The test given above is taken from the Leeds & Northrup Company's directions and is perhaps the simplest known to the writer. Another practical method of locating these faults is based upon relative capacity measurements and has considerable value. To make such a test, it is necessary to use a balistic galvanometer, a battery, condenser and discharge key. The battery or current source should preferably be an alternating current. There is also required a Wheatstone bridge, a condenser, a current detector, a telephone or a vibration galvanometer. To understand such a test, a thorough knowledge of measuring electrostatic capacity is necessary. There are many text books in

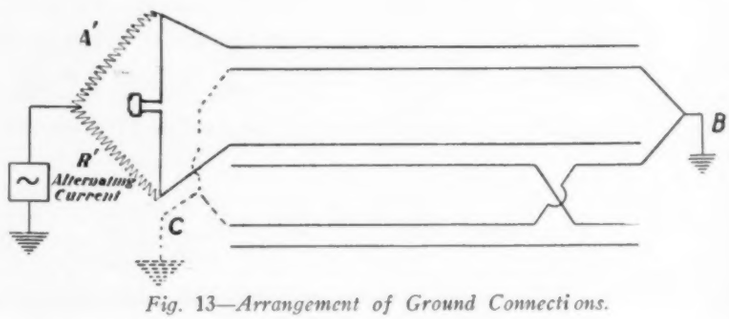


Fig. 13—Arrangement of Ground Connections.

The VICTOR wins the wise battery buyers

Mr. Walter R. McLean, general manager of the Peoples Mutual Telephone Company, operating fifteen exchanges in Montgomery, Madison, Bond, Macoupin, Christian and Fayette counties, Illinois, has been in the telephone business since 1912.

Yet, with a job like he has, he has time to serve as a member of the Montgomery County Board of Supervisors and to be active in Masonic and Rotary Club circles. That's a pretty good sign that his own business is running smoothly.

You can see in the Peoples Mutual properties McLean management's thoroughness and judgment that have made this enterprise a decided success.

The choice of Victor Batteries by this property is a significant example of the discriminating selection of supplies that makes the Victor users prosperous.

Peoples Mutual Telephone Company

Hillsboro, Illinois

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FARMERSVILLE HARVEL
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EXCHANGES
NEW DOUGLAS SORENTO
WAGGONER NOKOMIS
ROSEMOND WITT
RAYMOND

August 14, 1925.

Mr. A. J. Johnson,
A. J. Johnson Company,
Chicago, Illinois.

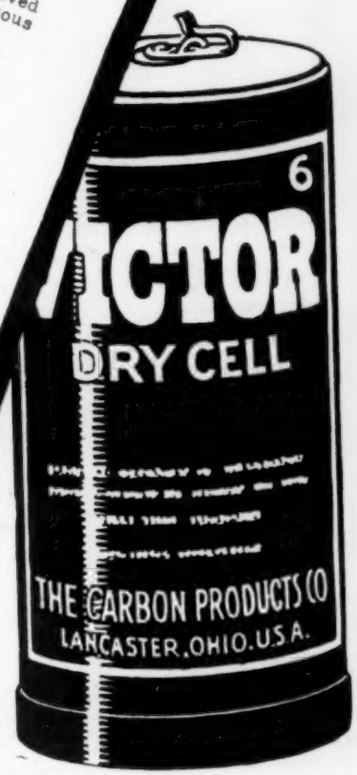
Dear Sir:

No. 6 Telephone Batteries which were installed on a telephone in my office June 14, 1922. They were removed from service August 13, 1925 after having had continuous use for three years, one month, and twenty-nine days. The use to which they were put during that time was by no means easy as the phone was used a number of times daily. You will note that one of the batteries still shows some amperage reading.

Thinking perhaps this would be of interest to you I am sending these batteries and giving you this record unsolicited. We have from time to time used a number of Victor cells on all kinds of magneto lines and have found them to give splendid service. Your manufacturers are to be congratulated on the good materials and careful workmanship they have put into their product. Also I can say the service of the manufacturers distributors has been equally as good.

Yours very truly,
Walter R. McLean
General Manager

E.A.M.: W.R.M.



You can see from this letter the kind of service that prompts Victor battery users to volunteer testimony of the superior performance of the battery, and to endorse the work of Victor battery jobbers.

There's plenty of reasons for you preferring Victor batteries right in the exclusive construction of the product. Better ask your nearest live jobber to tell you the plain facts about Victor construction. Then make up your mind.

THE CARBON PRODUCTS COMPANY

LANCASTER, OHIO

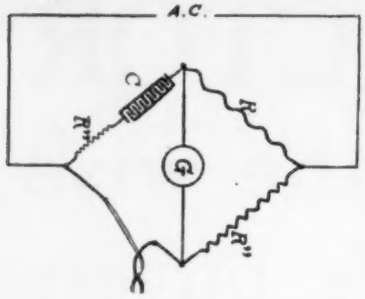


Fig. 14—A Split Pair Test Arrangement.

which this information may be found. A schematic arrangement for making a test of this kind is shown in Fig. 14, but the detail is too complicated for the average reader. In the diagram R, R′ and R″ are non inductive resistances, so wound as to have a minimum capacity. G is a vibration galvanometer or receiver. C a standard condenser and A C the alternating

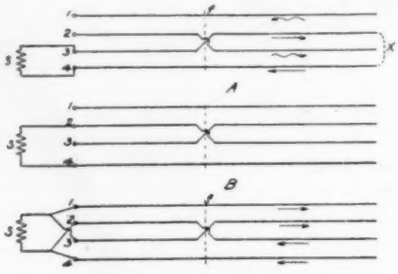


Fig. 15—Circuit for Locating Split Pairs.

current source. The resistance R″ is required to obtain balance. The plan of operation is to keep R′ constant and vary R and R″ until the galvanometer ceases to vibrate. R″ does not enter into the calculation. The formula used is R

$$\frac{}{R} = C.$$

Since R′ and C are constant the relative capacities are proportioned to R and since we are dealing entirely with relative values, the figures obtained by different tests are the resistances required to balance or give zero vibration to the galvanometer.

In Fig. 15 another circuit for locating split pairs is shown. Referring to this Fig., A, it is seen that 1 and 2, 3 and 4, are two pairs which are split at the point f. Ordinarily a connection x would be put on at the far end of the cable, thereby short circuiting the pair 3 and 4. The terminals of a secondary, S, of a howler tone should be attached to pair 3 and 4. In this way a howler tone is sent around the loop. Then by going along the outside of the cable with an exploring coil, the change in the relative positions in the wires at F can be protected and the trouble located. To avoid opening the cable to remedy the defect, attempts are made to locate the trouble by depending upon the capacity of the pairs in the dead end. It has been suggested that the following might be used to remedy this defect. Referring again to Fig. 15, A, it is noted that two straight arrows are shown indicating the direction of the impressed current at some particular moment. Then considering the pairs beyond f as a condenser, it will be evident that the effect of each of these impressed currents would be largely neutralized by an induced current in the opposite direction on wires 1 and 2. This current is represented in the diagram by wavy arrows. Our problem therefore is to do away with this neutralization which may be done by putting up the connection as shown in Fig. 15, C. The combination shown in B Fig 15, was made in an effort to balance the capacity, but did not work out satisfactorily. The combination shown in C not only neutralized but reversed the effect of the impressed current which was overcome, enabling the location of the split pair to be found.

Testing Internal Resistance of Batteries

The internal resistance of batteries is usually very small, especially storage batteries. In the case of dry cells, this resistance as they become worn out increases very rapidly, and very often runs into hundreds of ohms. It is therefore necessary sometimes to make tests to determine this resistance. This might seem easy at first and frequently an attempt is made to use the regular conductivity formula of the Wheatstone bridge. The principle of the Wheatstone bridge depends upon one of the corollaries of Ohm's law, namely, that the fall in potential over the resistance between a and

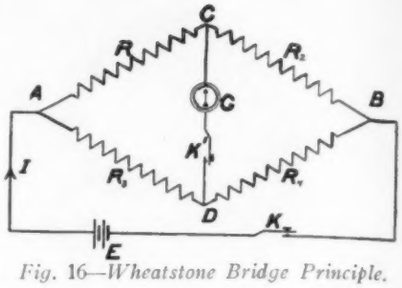


Fig. 16—Wheatstone Bridge Principle.

c, Fig. 16, and a and d are equal. Also that the resistance in the branches CB and DB have the same difference in pressure. If therefore a cell of battery is inserted in the branch CB as the unknown resistance an extra source of electro motive force is introduced which will increase or decrease the potential between CB, thus making it greater or less than that between D and B, depending upon which pole of the battery is connected to B. If the positive pole is connected to the point B, the EMF is in the same

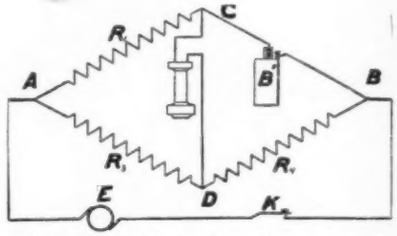


Fig. 17—Cell Testing Arrangement.

direction as that of the battery E and the voltage between C and B will be greater than that between D and B. If the nega-

(*Continued on page* 48.)

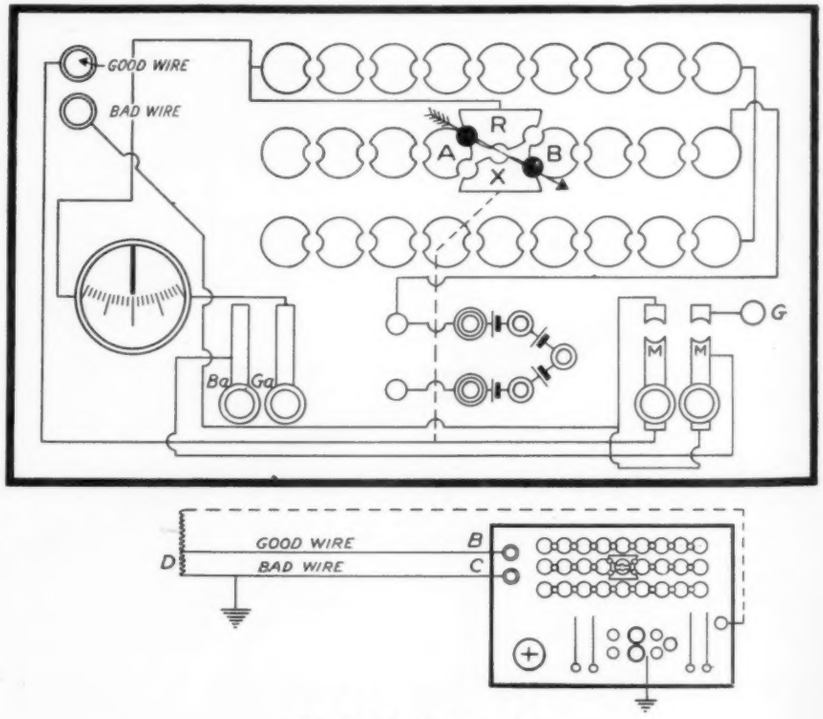


Fig. 18—Testing Circuit.

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LINE AND DESK

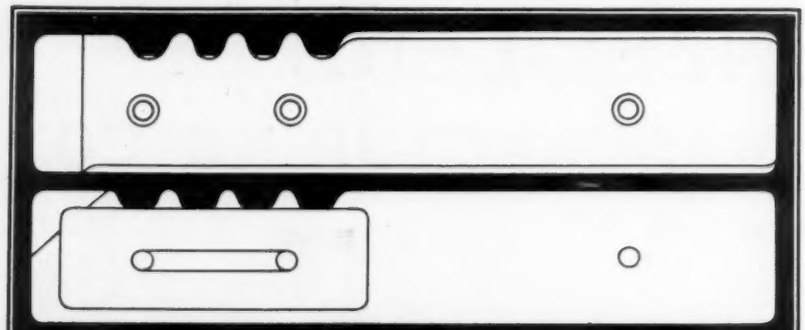
REPAIRING TINSEL SWITCHBOARD CORDS

Most telephone men consider it a difficult task to repair switchboard cords and oftentimes cords are discarded when their life could be at least doubled by cutting back or repairing, until all the reinforced part is cut off or until they become too short to reach all line jacks.

Anyone who has repaired cords knows what a difficult task it is to remove the outer braid with a sharp knife without cutting too deep and injuring the insulation of the conductor. To prevent this, and to speed up the operation, a very simple tool as shown in accompanying drawing, can be made. This tool consists of two pieces of hardwood, bakelite or fibre about 6 inches long, 1½ inches wide and ¼ inch thick, with three holes drilled through, two of which are spaced to hold a safety razor blade between them; two or more notches cut or filed across one side and one groove diagonally across one corner. It will require a little experimenting to get the notches of the proper depth so that just the outer braid will be cut when turned around the cord and not deep enough to injure the insulation of the conductors. The groove in the corner is to split the braid after it is cut around. If more than one type of cord is to be repaired with the same tool, the notches can be made to correspond to the different sizes of cord; otherwise, they are all the same but it is best to place as many notches as there is space on the razor blade so that all of the blade can be utilized before turning. Battery bolts for bolting the two sides of the tool together can be very satisfactorily used, the blade being sunk half its thickness in each side of the tool so that bolts will pull edges firmly together all around.

After plugs are removed from cords to be repaired, cut around cords about 1½ iches from end either with above tool or sharp knife and remove outer braid. Then, remove binding tape, filler cords and insulation from sleeve conductor, binding outer braid down at cut with from four to eight wraps of heavy thread or three-ply lockstitch. Then dip cord into beeswax hot enough to fry when a drop of water is dropped in it. Cord should be dipped into beeswax only about 2½ inches from binding. Cords could be dipped before outer braid is removed, but if this is done, care must be taken so that wax penetrates the insulation of conductors. Then bend back sleeve conductor over braid and screw on plug until binding on cord shows inside of plug. Cut off sleeve conductor at base of plug, about two turns before plug is entirely screwed on so that end will not show when plug is in place. On three conductor plugs, leave plug in position so that ring conductors will lie beneath the tip conductor in the plug. Next remove the outer insulation of the conductors with above tool or a sharp knife (if tool is used, a small slot can be provided in the tool for this operation). Flatten the tinsel conductor and inner insulation at the screw holes by squeezing with long nose pliers; pierce conductors directly over screw holes with a sharp pointed awl of scribe; insert binding screws into holes in conductors and plug with awl and screw in place with screw driver. The insertion of binding screws by use of a plunger screwdriver is a very simple task. In absence of a plunger screwdriver the screws can be inserted with little difficulty by using the awl and ordinary screwdriver. Cut off end of conductor about ⅛ inch beyond screw head.

This method of repairing tinsel switchboard cords will be found superior to soldering new tips on the tinsel, as the heat usually damages the tinsel, making it brittle and the cords become defective soon after placed in service. Cords carefully repaired in the manner just described will be equal to, and give, as good service as a new cord.—Contributed by Ray Blain.



This Is the Tool That Does the Trick of Removing Outer Braid When Switchboard Cords Are Repaired.

MORE CONCERNING RINGING MACHINE TROUBLE

Referring to the case of ringing vibrator trouble described in October number of TELEPHONE ENGINEER, N. E. Branson, Plant Superintendent of the DeKalb County Telephone Co., Maysville, Mo., contributes the following suggestion:

"Under the heading of, 'Line and Desk,' I note with interest the case of trouble concerning a five-frequency vibrator ringing machine. For the information of those experiencing this trouble, or any one else having such trouble, I would like to suggest a remedy for this difficulty, which I have every reason to believe will completely cure the situation.

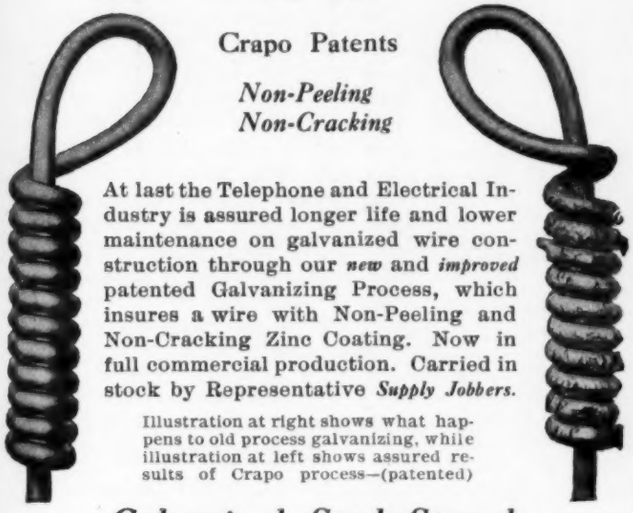
"In the first place, parallel operation of these vibrating units as shown on page 55 of your October issue, is without doubt the most practical method of hook-up, as the current supply to any one machine should not materially affect the remaining four—provided, we employ the proper resistance in each of the units connected, that is, in the motor magnets.

"While the resistance of the choke coil is not given in this case, we assume it to be of low resistance, yet of sufficient resistance to affect vibrator current supply, should one of the five machines fail to operate. In which case, any vibrator not operating will allow its motor coils to draw more current than when running or in motion; more especially in this case where the motor magnets do not have a greater resistance than 210 ohms.

"The remedy I wish to suggest in this particular case, is to change all five sets

"INDIANA"

Double Galvanized Telephone and Telegraph Wire



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CAN'T you just picture the wonderful time you would have at world famous French Lick Springs Hotel? Beautifully located in the semi-southern Cumberland foothills of Indiana, French Lick Springs knows no real severity of temperature. The two fine 18-hole golf courses can be played when weather interferes with play elsewhere.

Only 40 miles from the center of population of the United States. The recently completed new wing of the fire-proof, modern French Lick Springs Hotel building includes a well-ventilated ground floor, daylight convention auditorium of 1500 seating capacity, giving this hotel first place among America's convention sites. And, for those who wish, the health-giving waters of the Pluto, Bowles and Proserpine Springs.

Today, get full particulars. Write for illustrated booklet with detailed convention information. Address Convention Secretary, French Lick Springs Hotel Company, French Lick, Indiana.

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of motor magnets now in use having a resistance of 210 ohms, to motor magnets of higher resistance.

"In connection with a forty-volt battery, I would recommend the use of motor magnets of 800 ohms each, or a combined resistance of 1,600 ohms for each ringing vibrator set. And where only a 24-volt battery is used, I would recommend coils of 500 ohms, or a combined resistance of 1,000 ohms.

"With motor coils using a higher resistance than those mentioned, namely with 210 ohms, a more uniform current supply will be taken from the battery, heavy fluctuation of current will be eliminated and a smooth running of vibrators will be experienced."

A HINT IN CABLE TROUBLE LOCATION.

In testing for a case of cable trouble with the wireless type of cable test set, occasionally the tone will run past the fault and make the location difficult or impossible. I recently had a case like this and was about ready to give up when I happened to move some twisted pair wire which was in the same rings as the cable. The tone disappeared, indicating that I was past the fault. I repeated the tests and found that the tone was being carried past by the twisted pairs and that I was able to make an accurate location if I moved the twisted pairs several inches away from the cable sheath before applying the exploring coil.—Contributed by H. R. Granger, Clyde, Ohio.

SAFETY IN THE AIR

In the Bell System there are thousands of men who climb poles. These are the linemen, repairmen, combinationmen, splicers, installers, and others who contribute their share of the effort that makes our nation-wide service a reality.

These men work under all kinds of conditions; good weather and bad; sometimes at night, mostly in daytime; now in a crew under the immediate supervision of a foreman and then alone, possibly at some isolated place miles from nowhere.

These men know that while the risks of their work are not very great there are types of accidents which are more or less common to all men who work aloft.

The accidents met with by the climbers of the System furnish a study that should be helpful to the men who do the same work in our company.

During a recent period of several months for the Bell System, accidents of the number indicated were from the following causes:

Falling or slipping from poles (except spurs cutting out), 46.

Spurs cutting out, 38.

Body belts and safety straps, 12.

The above list does not include all accidents which happened, or all that happened to climbers—but all of a particular class of accidents. By that is meant many which could have been prevented:

If care were used in ascending or descending poles.

If belts and straps were used or used correctly.

If climbers, belts and straps were in good condition.

All of our plant people are supposed to be familiar with the Accident Prevention Code, particularly that part of it that applies to their work.

If all of our men who climb poles would be absolutely familiar with its requirements regarding this class of work and would practice them diligently, we could eliminate many serious accidents.

In the first place, climbers should be worn only when required to climb poles—never when traveling to and from the work or between jobs. They shall not be worn when climbing fences or when on stepped poles, where the steps permit the required work without climbers.

Before climbing always inspect the straps and gaffs of the climbers. The straps should be in perfect condition and the gaffs must be sharp and not less than one and one quarter (1¼) inches in length. Do not trust short or dull gaffs, and if they are loose immediately replace the climbers.

The safety strap and body belt shall also be inspected before ascending the pole. The method of making detailed inspection is fully covered by the Code, and you should be familiar with it.

In climbing a pole the hands shall be free and not grasping a handline or other tools or material. It is bad practice to encumber the body with material; for example, coiled wire over the shoulder or blouse stuffed with insulators.

While in position on the pole the body belt and safety strap should be used.

The following rules in connection with the use of body belts and safety straps are rather elementary, but they are summarized here because of their importance:

(*a*) Before leaning back on a belt and safety strap the workman should be sure that both snaps are properly engaged in the Dee rings.

(*b*) While wearing a body belt and safety strap both ends of the strap when not in use should be snapped into a single Dee ring.

(*c*) The body belt and safety strap should never be thrown or dropped from a pole.

(*d*) Should a lineman climb past a fellow-worker who has his safety strap placed around the pole, he should exercise care to avoid dragging the climbers over it and thereby cutting the fellow-worker's safety strap.

(*e*) The body belt should never be used to assist in piking poles, as this practice, should the workman slip or stumble, may result in the pike pole sliding down between the belt and his body, with the possibility of injuring him seriously.

(*f*) The body belt and safety strap shall not be used as a means of riding suspension strand.

Remember, you linemen, repairmen and others who climb, when you are working aloft you are out of your natural element. Make sure the pole will support you. Do not remove guys, wires and other supports until you are sure of this. Do not trust your life to faulty climbers and safeties, and use these tools correctly. Take constant care when up a pole so that when you come down, it will be "right side up" and in perfect condition. —J. L. Vandergrift in *"The Transmitter."*

PHILADELPHIA FOR 1926 CONVENTION?

The 1926 national Independent telephone convention may be held outside of Chicago, for the first time in many years. Philadelphia is being considered, and if chosen the meeting probably will be held the latter part of June. Final action on the proposition is to be taken by the U. S. Independent Association and affiliated manufacturing interests Nov. 14. The Quaker City is offering many inducements for this particular meeting, including a great convention hall and splendid arrangements for exhibits. The site is on the water, with battleships, hydroplanes and submarines within a stone's throw. Exhibits of every kind are to be there, in addition to an unusual line of telephone apparatus and accessories. All this, of course, is due to the Sesqui-Centennial exposition which will be in progress at Philadelphia then. Late June usually finds the East in its happiest garb, with good roads inviting motorists, while rail and water routes will offer especially attractive rates. Such conditions, and the many new and interesting things to be seen and learned on such a trip, may for the once, outweigh Chicago's usual advantages as a great convention city—providing Philadelphia puts on the kind of show it has promised.

Brand And Solder The Everhot Way

Don't confuse the Everhot Combination Outfit with any other branding iron. The Everhot stays hot and brands continuously—no waiting to reheat. The torch, which is attached, keeps the brand hot for hours of continuous service. Here is a real combination outfit that can be used not only for branding purposes but also as a torch and soldering iron.

Use the Everhot for branding your new poles and crossarms while they are in the yards, as well as for branding your standing poles. Branding your poles in the yard protects you against confusion as to ownership when they are delivered ready to raise. At the same time it marks your poles for future identification. The company name and identification number branded into these poles make it easy to issue working orders, telling linemen just where to make repairs.

Use the Everhot also for burning the proof of your ownership into all your working tools and equipment. Tools marked in this way do not mysteriously disappear. They remain your property until they are worn out.

The fuel—ordinary gasoline—is in the handle, and the torch is ready to use anywhere—any time.

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America's Brand Makers
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"Cope" *Established 35 Years*

Specialties

are the standard for underground cable construction work

Send for Catalogue

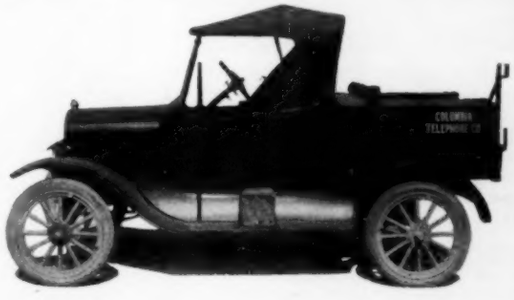
Manhole Guard Rails
Cable Reel Jacks
Cable Bending Tools
Bond Plates
Bond Wire
Conduit Rods
Cable Racks

T. J. COPE

Manufacturer of
Tools and Supplies for Underground and Overhead
ELECTRICAL EQUIPMENT

Chicago Office:
No. 19 So. La Salle St.

2112-2114 Sansom St.
Philadelphia, Pa.



Type SC-172 Cabinet Body

A strong, light-weight, convenient cabinet body used in connection with the standard Ford roadster. Soon repays its first cost. Standard equipment with some of the largest telephone and power companies. Equipment includes ladder irons and rear fenders.

Write for Bulletin No. 214 giving prices and full information.

HOOVER BODY COMPANY

York Pennsylvania

Bell Pioneers Make Thayer Chief at Twelfth Convention

Washington, D. C.—H. B. Thayer, chairman of the board of the American T. and T. Company, was elected president of the Telephone Pioneers of America, the Bell veteran organization, at the twelfth annual convention of the society.

Attendance at the meeting was approximately 2,500, which included presidents and delegates from each of the 36 chapters of the Pioneers.

Growth of the Pioneers was brisk during the past year. Since January 1, 1925, 2,097 have been admitted to the organization, bringing the Pioneer roster up to 10,038 at the date of the convention. Among those who became eligible this year was Walter S. Gifford, the Bell president, who entered the Pioneer's ranks as the ten thousandth member. Ten new chapters have been formed since January 1, 1924.

Program of the opening day featured "Chapter Activities," and had as speakers on this subject J. W. Dietz, New York City; Miss Daisy Thomas, Portland, Ore.; D. M. Therrell, Atlanta, Ga., and Charles E. Hall, Omaha. Miss Thomas is the only woman president of a Pioneer chapter.

Ben S. Read, retiring president of the Pioneers' key-noted his address with an outline of the Pioneers' responsibilities toward the young people in the telephone business.

One of the interesting semi-technical features presented before the convention was a presentation of the Bell system's new developments for aiding the deaf and dumb which was made by Dr. Harvey Fletcher of the Bell Telephone Laboratories, assisted by J. B. Kelley. M. J. Bishop, president of the Western Pennsylvania chapter, made a very well received inspirational address.

A boat trip to Mount Vernon was one of the entertainment events of the meeting. Other details of the lighter side of the conclave included several dances, moving pictures of the convention, and a series of tableaux grouped under the title, "The Pioneer's Scrap-book," depicting significant incidents in the development of the telephone industry, and a sketch, "Twenty Minutes with WCAP," featuring several popular broadcasters. A review of the various chapters supplied a lively windup.

BELL PIONEERS ELECT

President—H. B. Thayer, chairman of the board, American T. and T. Company.

Senior Vice President—F. A. Stevenson, director, Long Lines Department, American T. and T. Company.

Vice President—J. S. McCulloh, president, New York Telephone Company.

Vice President—M. B. Jones, president, New England T. and T. Company.

Vice President—J. E. MacDonald, secretary-treasurer, Mountain States T. and T. Company.

Executive Committee (for term of two years—1926 and 1927)—B. A. Kaiser, special representative, American T. and T. Company, New York City; J. L. Kilpatrick, vice president, Western Electric Company, New York City.

Hold-over Members of the Executive Committee—E. K. Hall, vice president, American T. and T. Company, New York City; Miss Ida Krebbs, cashier, The Ohio Bell Telephone Company; Henry McDonald, commercial representative, American T. and T. Company.

Construction Truck Bodies a Hoover Specialty

York, Pa.—Considerable business from the country's telephone companies is coming into the Hoover Body Company's plant here as a result of the Hoover company's specialization on truck bodies for light construction work. The Hoover company has a number of stock types that handle most of the ordinary requirements of telephone company work. These bodies have been designed and built after a lengthy study of the needs of the job. These stock bodies, and those the Hoover company makes to the specifications of companies that have their own particular ideas, have marked the Hoover company as the foremost factor in this line.

New literature is available on Hoover bodies for telephone company construction trucks. This printed matter will be sent on request.

WANTED

One copy of December 1920 TELEPHONE ENGINEER is wanted by a subscriber for completing his files. Subscription will be extended three months for a copy of this issue.

TELEPHONE ENGINEER
Circulation Department
28 East Jackson Blvd., Chicago, Ill.

(*Continued from page 42.*)

tive is connected to B, then the difference will be less as the cell under test will oppose that of the battery E. To overcome this effect which would give us inaccurate results, the use of an alternating current has been adopted as shown in

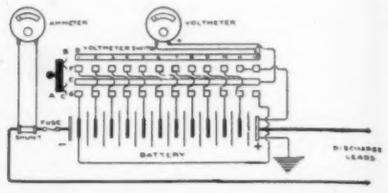


Fig. 19—Arrangement to Test Electrical Condition of Each Cell and Battery as a Whole.

Fig. 17. It is a known fact that an alternating current may be passed through a battery without serious injury to the cell and since the voltage of the cell will not materially affect the strength or character of the alternating current, the standard method of testing by the Wheatstone bridge may be used by replacing the direct current with an alternating current, which may be a ringing generator or a converter of some kind suitable for this purpose. It is also necessary to use a receiver instead of a galvanometer. A slide wire bridge may also be used for this test as shown in Fig. 1. The resistance of a battery may also be made by using a voltmeter and ammeter as shown in Fig. 18. The instruments used in such a case are a voltmeter and ammeter of proper range. For single cells, the voltmeter should read three volts and the ammeter five amperes. The circuit for this arrangement is shown in Fig 18 and is self-explanatory. Readings are taken simultaneously. If a storage battery is being tested, then the resistance obtained is the sum of the internal resistance of the series, assuming each cell to have the same resistance. This can be modified when measuring accumulators or storage cells by measuring the charging current and difference in pressure between the terminals of the battery simultaneously; then after breaking the circuit measuring the voltage of the battery. Fig. 19, shows an arrangement whereby the electrical condition of each cell and the battery as a whole can be obtained, using a volt meter and an ammeter.

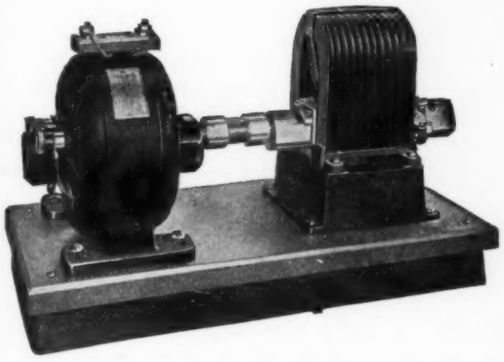
CORRECTING AN ERROR IN AN OCTOBER ADVERTISEMENT

Through error, five unauthorized lines were used at the bottom of the Carbon Products company page advertisement in the October issue of TELEPHONE ENGINEER.

Jacksonville, Fla.—Work on the new $412,500 Lakeland home of the Peninsular Telephone company is nearing completion.

Generators vs. Batteries

Is your ringing service Dependable and Constant?



THE HOLTZER-CABOT ELECTRIC COMPANY'S MAGNETO RINGING MOTOR GENERATOR

does its work under any and all conditions, without variation. It never fails. No battery exhaustion; no battery renewals; no contact adjustments—but constant service.

THE HOLTZER-CABOT ELECTRIC CO.

125 Amory Street, Boston, Mass. **6161 S. State Street, Chicago, Ill.**

YOUR TELEPHONE DIRECTORY

Is the advertising in it developed as it should be?

If not we can help you.

We have been selling the advertising for years for a large number of the leading Independent Telephone Companies, and they have found our services profitable and satisfactory because we sell more advertising at better rates, and at the same time relieve their organizations of this work so that they can devote more time to matters pertaining strictly to the telephone business. We also publish telephone directories.

Write for our proposition.

CRAVEN & BERRY

Telephone Directory Advertising

Main Office: Keith Building, DAYTON OHIO

Rochester	Philadelphia	Ft. Wayne	Terre Haute
Jamestown	Camden	Lorain	Bloomington
Plattsburg	Oil City	Mansfield	La Crosse
Johnstown	Butler	Lima	Lexington
Erie	Kittanning	Marion	Bluefield
Owosso	York	Newark	Knoxville

The Proof of The Pudding

The spicy fragrance of a tempting pudding is only the *promise* of its goodness. Real proof comes in the eating.

Likewise, the only *real* test of a telephone battery is actual use, but years of practical experience have convinced executives that the service from French Telephone Batteries is *always* up to expectations. That is why they are standard with hundreds of telephone companies.

Also makers of French Ray-O-Vac Batteries. 11 models cover every radio use.

FRENCH BATTERY COMPANY
Madison, Wisconsin

Atlanta Dallas Denver Kansas City
Chicago New York Minneapolis

FRENCH
TELEPHONE BATTERIES

George Eaton New Chief Engineer of Kellogg

Chicago, Ill.—The Kellogg Switchboard & Supply Co. announces appointment of George R. Eaton as its chief engineer. Mr. Eaton, widely-known among telephone men over the United States, is a product of the Kansas State College, having graduated from that institution in 1908 with the degree of B. S. in electrical engineering.

Mr. Eaton joined the engineering department of the Kellogg company in 1914, his work in the telephone business

George R. Eaton, Kellogg's New Chief Engineer.

prior to that time having been with the operating telephone companies. He has had considerable experience in power engineering.

For the past two years, he has spent much of his time in apparatus engineering, although his work since he went with the Kellogg company has been in development, particularly of switchboard equipment, Mr. Eaton having had a great deal to do with the multiple switchboard installations made by the company. He therefore assumes the responsibility of the position of chief engineer of the Kellogg Switchboard & Supply Co., with an especially fine experience, due to his general knowledge as electrical engineer, his operating experience in the telephone field, and his thorough training in the Kellogg engineering department. He has expressed himself as anxious to have all of Kellogg's friends and customers feel free to call on the engineering department for any aid it may be able to give in solving the many problems of an operating telephone man.

Mr. Eaton is married and has one daughter, Dorothy. They live in Oak Park, Ill., one of Chicago's western suburbs.

CONVENTIONS

ILLINOIS

Springfield, Abraham Lincoln Hotel, November 18-19.

SOUTH DAKOTA

Sioux Falls, Cataract Hotel, January 12-14, 1926.

NORTH DAKOTA

March 9-11.

London, Eng.—Results of "telephone push" conducted during the past year by the Post Office, show a 10% increase in the number of telephones in Great Britain.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

of Telephone Engineer, published monthly at Chicago, Ill., for October 1, 1925.
State of Illinois, County of Cook, ss.

Before me, a notary public, in and for the state and county aforesaid, personally appeared W. H. Graffis, who, having been duly sworn according to law, deposes and says that he is the general manager of Telephone Engineer and that the following is to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication, for the date shown in the above caption, required by the Act of Aug. 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, general manager and business manager are:
Publisher, Telephone Engineer, Chicago, Ill.
Editor, Herbert Graffis, Chicago, Ill.
General Manager, W. H. Graffis, Chicago, Ill.
Business Manager, Jos. M. Graffis, Chicago, Ill.

2. That the owners are (give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding one per cent or more of the total amount of stock):
W. H. Graffis, Herbert Graffis and Jos. M. Graffis, all of 28 E. Jackson Blvd., Chicago, Ill.

3. That the known bondholders, mortgagees and other security holders owning or holding one per cent or more of total amount of bonds, mortgages, or other securities are (if there are none, so state).
—None.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustees or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any person, association or corporation has any interest, direct or indirect, in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed through the mails or otherwise, to paid subscribers during the six months preceding the date above is.....
(This information is required from daily publications only.)

TELEPHONE ENGINEER,
W. H. Graffis, Gen. Mgr.

Sworn to and subscribed before me this 6th day of October, 1925.
(Seal) ETHEL E. MATSON.
(My commission expires Feb. 8, 1926.)

Telephone Men Share in Talking Machine Triumph

New York City.—The new Orthophonic Victrola, which has registered in sales and in public interest as one of the greatest sensations recently presented to the music-loving public, is the result of the combined inventive genius of the Bell Telephone Laboratories, the Western Electric company and the Victor Talking Machine company. The invention is said to reproduce, for the first time, the entire range of musical sound.

Texas Holds Big District Meet at Georgetown

Georgetown, Tex.—A hundred telephone men and women attended the first small town district meeting and traffic conference. Twenty-nine telephone companies were represented. The Georgetown meeting, which was in the nature of an experiment, proved to be the largest and most successful in the history of the state's district meetings. R. B. Still, president of the state association, presided.

CHICAGO SEES BIG SHOW

(*Continued from page 27.*)

Ferguson and Knox. They also told details of the new Block "judgment indemnity insurance."

Addressograph Company had D. O. Harrell and I. O. Marsh demonstrating the Addressograph equipment and systems that do so well in simplifying telephone addressing and accounting.

Al Johnson, whose A. J. Johnson Company is rapidly growing as an electrical jobbing enterprise, was well represented at Chicago. In addition to the hard-working and popular Johnson youth, the layout had on hand S. Warnick, P. T. Figved and O. S. Johnson. Johnson's display featured Victor batteries, Superior tapes, iron and copper wire, and other supplies.

V. L. ("Hap") Crawford and Harry Knelson, representing the Everstick Anchor Co., showed the Everstick, an improved tamping bar, a new cable ring, the Davis cable chair, Blackburn messenger splicers and other Everstick spe-

---

Superior Rubber and Friction Tapes
Hot Galv. Pole Line Hardware
Cedar Poles, Northern and Western
Victor and Ace Batteries
Radio Equipment

A. J. Johnson Co.
217 No. Desplaines St., Chicago, Ill.
(Tel. Haymarket 9189)

cialties that the perennial Hap has been recommending so highly to telephone men for some years.

Spencer Pritchard had charge of the interests of L. S. Brach Mfg. Co., doing a good job of boosting Brach lightning arresters at the meeting.

Warner Jones, with the Victor battery, did his Carbon Products Co. a lot of good at Chicago. Jones, who is one of the veterans in this dry battery business, has a great selling story to tell about the construction details of the Victor batteries for telephone and radio and flashlight use. The story must go over well and pan out O. K. for the Carbon Products plant is doubling its capacity in 1926. This expansion is in line with a growth that has been marked during the past several years. R. R. McCracken, district sales manager, also was present and active.

Cook's new all-steel galvanized X-type unprotected terminal box drew interested crowds during the convention. The cable is taken out of the top or bottom of the terminal by simply reversing a hood. Cook's new aerial-to-underground terminal and the Cook all-steel protected terminals, together with the Cook central office heat coils, were objects of considerable attention. Representing Cook at Chicago were G. R. Folds, John Jaap, D. C. McKee, Chester ("Babe") Ruth and Earl Shields.

John Coffey, whose duties as an operating telephone man recently again have identified him as one of the industry's "fair-haired" boys, was at the Coffey System's display of telephone accounting methods and supplies. W. J. Marold was in charge of the exhibit.

Holtzer-Cabot showed for the first time at a telephone convention an induction type of tone machine. This was one of the highly interesting novelties at Chicago. The usual Holtzer-Cabot exhibit of charging motor-generator sets and ringing motor-generators, headsets and loud-speakers also was presented by T. G. Meinema, M. E. Gault and Wm. Reid.

Lamp supervision for magneto switchboards, new code ringing drops for small switchboards and the Leich magneto multiple switchboard provided the big show at the Leich Electric Company display. These three features have been responsible for a very lively volume of Leich's business during the last twelve months. Leich's radio sets, which also have enjoyed profitable popularity, were shown at Chicago. Representing the Leich company were: O. M. Leich, secretary and general manager; A. J. Kohn, sales manager; A. C. Reid, chief engineer; B. L. Parker, advertising department; John A. Campbell, of Ohio; T. J. Gullion of Indiana; W. S. Fisher of Illinois, and Carl Malmborg of Iowa.

The Mulnix pole jacket came in for a great deal of attention at Chicago, its function of protecting and preserving the pole strength and life, proving interesting to telephone men. The Mulnix device, according to the consensus, is the most practical solution of handling the ground-line decay problem that has been presented. Explaining the Mulnix jacket were S. M. Mulnix, F. A. Sherman and W. S. Wade.

C. MacIntyre, G. C. Merritt, S. Walters, J. A. Duncan and S. H. Simonsen handled affairs for the Illinois Electric Company. Illinois had a big line of telephone supplies and radio equipment on display.

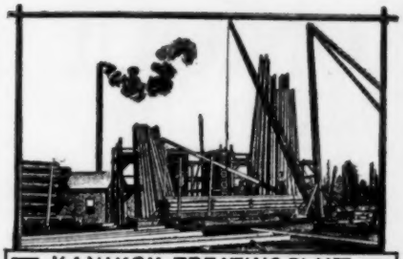
J. K. Johnston, the lively Independent veteran, made his headquarters in room 110, where he held open house on telephone engineering problems and renewed acquaintances with his host of friends.

Busy as usual, the French battery folks were all present or accounted for at Chicago. The head of the organization, J. B. Ramsey, G. C. Harrison, general sales manager and assistant to the president, Frank Foster and B. J. Clark were there, with the prime conventioneer of the chronic conventioneers, Frank Eldridge. The new French carton was shown. French batteries now may be had with flat spring connectors without additional charge.

C. P. Harrah, general manager of the Harrah Mfg. Company, conducted some brisk sessions with the convention attendants who were interested in construction methods, when Harrah explained the Handyman pole jacks, guy stretchers, pole pushers and rapid pole pullers. These Handyman devices are getting to be standard equipment and their progress was hastened by the success of the Chicago showing. Bronze bushings in the pivot bearings of the pole puller jack were one of the new features of the equipment shown at Chicago.

National Cable Compound Company, makers of the popular Ever-Protect cable compound, introduced Ever-Protect in liquid form at the Chicago meeting. Liquid Ever-Protect immediately jumped into sales prominence. S. M. Isom, president and general manager of the company, and K. K. Drane were in attendance at the Ever-Protect booth.

Stromberg-Carlson was in battle-array both in equipment and sales representatives. Headed by the super-service switchboard, the Stromberg-Carlson line-up presented all of the features of the catalog, in boards, telephones and supplies. The Stromberg-Carlson console-type radio set was one of the convention's beauty spots. Those who were at Chicago for the Rochester company were: W. Roy McCanne, president; G. A. Scoville, vice-president and sales manager; R. H. Manson, chief engineer; C. W. Schafer, manager of Chicago office; A. J. Roberts, manager of Kansas City office; N. W.



KANIKSU TREATING PLANT

WESTERN
RED CEDAR
POLES
FROM THE
Kaniksu National Forest
All Styles of BUTT TREATING
KANIKSU CEDAR CO.
PRIEST RIVER, IDAHO
LOS ANGELES OFFICE
Harry G. Holabird - 451 E. 3rd St.
EASTERN OFFICE
Baker & Ross, Inc. 30 Church St. New York City
DENVER OFFICE
Geddes & Aldom - 300 Int. Tr. Bldg.

KANIKSU RED CEDAR POLES

Everstick

Approved by Large Operating Companies For the Following Strains

6"	2-way	2,200 lbs.
6"	4-way	6,000 lbs.
8"	2-way	6,000 lbs.
8"	4-way	10,000 lbs.
10"	4-way	16,000 lbs.

Write for Details

Everstick Anchor Co.
ST. LOUIS, MO.

$37.50

Addressograph

CHEAPER than typewriter—SAVES 20% of YOUR present costs — 5 to 15 times FASTER and BETTER than pen or typewriter.

FREE TRIAL will prove it!

904 W. Van Buren St., Chicago, Ill.

WANTED—To buy used transmitters. 125 W. North Ave., Olney, Illinois.

Baldwin, manager of Toronto office; E. A. Reinke, assistant sales manager; W. T. Eastwood, advertising manager; C. E. Heston, manager of construction material and supplies; H. T. McCaig, assistant manager of Chicago office; J. H. Lewis, C. W. Watson and J. C. Snyder, sales engineers; R. Davis, M. D. Wood, A. M. Roberts, J. A. Taggart, W. C. Caldwell, B. H. Merriman, C. D. Kinne and P. Winemiller, sales representatives.

Spencer Gullickson put on an exhibit for the Churchill Cabinet Company that was greatly appreciated. He had one of the standard Churchill telephone booths installed right outside the convention floor. All calls were made at Gullickson's expense.

Growth of Copperweld wire's business in the telephone industry has a substantial foundation so W. Marshall Page, chief engineer of the Copperweld Steel Company, and Erick Elg, of the company's engineering staff explained to the many who visited the Copperweld exhibit. Line wire, drop wire, twisted pair, messenger strand and guy wire samples were shown.

M. E. McCall and C. L. Bend of the Electric Storage Battery Company put forth the case for the Electric Storage Battery Company's telephone and radio storage batteries.

J. Mayo Lenz and Phil Lenz held forth at the Runzel-Lenz Electric Mfg. Company's quarters where the company's twenty-first birthday was being observed. In its twenty-one years of specialization as telephone cord makers the R-L interests have built up a great business, this year being one of the finest in the history of the company. The convention leader was the Runzel-Lenz moisture-proof tinsel switchboard cord. Specimens of the complete R-L line of switchboard, telephone and radio cords were shown.

Wallace Cook and George Rodormer, Reliable Electric Company magnates, assisted by Joseph Stelzer, heard the many customers who called at the Reliable display tell that the Reliable claims of satisfaction from saw-tooth protection were amply borne out by performance. In the infrequent lulls between business confabs Cook and Rodormer were able to say a few kind words for the Dartmouth football team. Both of the Reliable men have sons in the Green Mountain school and naturally are inclined to think well of anything pertaining to the establishment.

A "Sensible" switchboard headed the Monarch batting order in the Chicago display. Other boards and telephones of the Monarch line were attractively presented, as were the full line of supplies handled by the company. Monarch men in attendance were: L. Q. Trumbull, general manager; G. O. Wilson, sales engineer; A. W. Steinke, chief engineer; R. W. Siemund, manager supply sales; V. A. Moscow, equipment sales; P. A. Foagh, equipment sales; L. V. Anderson, supply sales; E. F. Kinson, advertising department; R. C. Chock, engineering department; field representatives R. O. Palmer, Minnesota, South Dakota, North Dakota; H. C. Shear, Iowa, Nebraska; I. D. Viets, Missouri, Kansas; E. E. Donoho, Texas; E. R. Paris, Illinois; C. W. Snyder, Indiana, Michigan; P. L. Picot, Ohio.

Again National Carbon helped the convention "keep the doctor away" by distributing apples. The Columbia "Gray Label" prescription for keeping the doctor away from telephones was shown in a Hallowe'en setting. Columbia dry batteries and the Ever-Ready line of radio and flashlight batteries were presented to the throngs by J. M. Spangler, manager of the Chicago office; Alvin Zinkan, assistant manager of the Chicago office; E. F. Schulz, telephone specialist of the Chicago district; R. R. Brooks, Minneapolis, Minn., representative; D. L. Gardner and C. R. Howell, representatives of the Chicago district.

Testing equipment as the attraction brought a large number to the quarters of the Thompson-Levering Company. W. J. Thompson, president of the company, had on display a comprehensive exhibit of Thompson-Levering equipment including the T 2000 and T 2002 switch dial testing sets, the T 2010 plug set, T 2062 fault finder and the 12001 toll test board.

Eugene Goller and Oren Foster put the Unique line of gasolene and kerosene furnaces and torches through its paces and made it perfectly plain that these devices are manufactured with a degree of expert ability that distinguishes them in their fields. Many were held in close attention by the outline of the Unique's exclusive construction features which include an automatic orifice cleaner and an automatic top-plate gate which permits removal of the generator without dismantling the entire device.

Possibilities of well-handled telephone directory printing and advertising were revealed in the interesting display made by the firm of Craven and Berry. Craven and Berry directories have a circulation of more than 1,250,000 a year, being distributed through many telephone companies in the central west and east.

Atmosphere of the "wide open spaces where men are men and poles are Page and Hill's" continued to demonstrate its lure. The fragrance of the cedar boughs spread on the floor of the Page and Hill exhibit brought quite a congregation into the room where the seekers of the light were received by Grant Harris, Buford Adams, L. E. Morier and F. C. Treat.

Other influential interests in the cedar pole business, the Naugle Pole and Tie Company, were represented by A. J.

UNIQUE
BLOW TORCH

It starts quickly, operates in any position, and produces a remarkable heat. It is a great worker in cold and windy weather.

The automatic orifice cleaner, one of the details shown in the illustration, is but one of a number of exclusive features that make the Unique your greatest value in blow torches.

Painstaking care by interested workmen, an actual "burning test" before shipping, is just another detail responsible for their uniformity and efficient burning qualities.

Write for complete details

Unique Manufacturing Co.
113 N. Desplaines St. CHICAGO, ILL.

RECONSTRUCTED EQUIPMENT

Kellogg No. 39 C. B. Unbreakable desk sets complete with No. 75 Straight line steel Bell Box @ $7.00—Harmonic with 16-33-50 or 66 cycle ringers @	$ 7.50
Kellogg No. 97 Common battery Unbreakable desk sets complete with No. 75 straight line steel Bell Box @ $8.00—Harmonic 16-33-50 or 66 cycle @	8.50
Kellogg No. 28 type 3-bar 1000-1600 or 2500 ohm Bdg. desk set @ $10.00—4-bar @ $11.50—5-bar @	12.00
Monarch 3-bar 1000-1600 or 2500 ohm Bdg. compacts @ $7.00—4-bar @ $7.50—5-bar @	9.00
Stromberg No. 896 type 4-bar 1000-1600 or 2500 ohm Bdg. compacts @	8.50
Stromberg No. 599 type 4-bar 1000-1600 or 2500 ohm Bdg. Compacts @	7.00
Stromberg No. 599 type 4-bar 1600 ohm Bdg. central Checking compacts @	7.25
Western Elec. Co. No. 305 type 2 or 3 bar 1000-1600 or 2500 ohm Bdg. hotel sets—with or without biasing attachments on ringer @	6.50
Western Elec. Co. No. 250 Transmitters complete with mouthpiece and backs @	1.35
Kellogg Local or C. B. Transmitters, complete as above @	1.10
Dean or Garford Brass cup receivers, complete with new shells and cord @	1.10
Double pole single throw 15 amp. knife switches @	.15
Garford Unbreakable type 3-bar 1000-1600 or 2500 ohm Bdg. desk sets $8.75—4-bar $9.25—5-bar @	10.25
Stromberg No. 992 type 3-bar 1000-1600 or 2500 ohm Bdg. desk sets @ $10.00—4-bar @ $10.50—5-bar @	11.00
American Elec. Monarch or Federal Tel. 4-clip local battery Ind. coils	.35

Write for our new price list just off the press.
REBUILT ELECTRIC EQUIPMENT COMPANY, Not Inc.
E. C. Stoeffhaas, Mgr.
1940 W. 21st Street, CHICAGO, ILL.
We are not connected with or successors to Rebuilt Telephone Equip. Co.

Naugle, Ed Naugle and Col. Frostenson, the noted golfer.

The southern yellow pine people had another champion of their cause in the National Lumber and Creosoting Company. The showing of this company included sections of pressure treated sections of yellow pine poles, data on pipe poles and on the National Lumber's facilities. The National men at Chicago included C. B. Mitchell, W. W. Lawson and C. H. Brooke.

A. A. Ahlgren of the Prestolite Company explained the advantages of Prestolite equipment for linework, bringing out among other details that the Prestolite outfit's use was not confined to the larger companies.

Harry Sander, president of the Rochester Self-Binder Co., Inc., and W. Z. Fuller, Chicago representative of the company, staged the debut of the Rochester temporary and permanent binders at a national convention during the Chicago meeting.

Con. P. Curran, Jr., of the Con P. Curran Printing Company, operated at full speed during the Chicago meeting. Curran has an interesting proposition on standard printed forms for telephone company use, due to the Curran plant's development of some exclusive methods of producing printed forms.

Electric Instrument Repair Company was represented by Charles Nemac, who did considerable good for himself by the orders booked at the convention.

One of the new radio sets that is being campaigned among telephone men is the Eidson, which was explained to the convention attendents by its inventor, G. N. Eidson and D. D. Olmetti.

Conduit business this year has been in good shape according to F. N. Gormley of the Clay Products Co., who attended the convention in the interests of one of the foremost midwestern makers of conduit.

"The jack that saves your jack" was handled at the convention by Charles Crane, Jr., and W. H. Kreer. These Simplex pole pulling and straightening jacks and cable reels have been received and adopted internationally by a number of the leading telephone companies, according to Crane, who has been responsible for the big development of Templeton Kenly's Simplex business in the telephone industry, in his capacity as chief of the telephone department.

Standard Underground Cable Company had a big exhibit of its products which included telephone cable, rubber insulated telephone wire, bare and weatherproof copper and copper-clad wire, and rubber insulated and braided copper-clad steel drop wire. Catching a perfect game at the order book end for the Standard Company were E. J. Pietzcker, St. Louis, Mo.; Arthur A. Anderson, Pittsburgh, Pa.; Bruce W. Dolch, Kansas City, Mo.; W. M. Rogers, J. J. Hohmann, H. K. Weld and Lester P. Shull, all of Chicago.

An ingenious new stunt in the tree-trimming line was introduced to the convention by the Roy-Jax Company of Audubon, Iowa, which was represented by the inventors of the device, Roy Wiard, an experienced telephone man, and A. J. Van Sise. The Roy-Jax trimmer will cut limbs several inches in diameter and has a working range as high as 25 feet above the ground.

C. T. Lambertson, with his Stacy load binders, continued his convention practice of doing a lively business. The Stacy idea for tightening guy wires with the use of the popular Stacy load binder received considerable interest from those who were at the Chicago meeting.

H. O. Cauldwell, H. M. Barber, J. H. Blanchard and E. T. Weart were the troupe caring for the interests of the John A. Roebling's Sons Company. Per their usual schedule, they made the meeting pay out for Roebling's.

Meridian, Okla.—S. W. Woods, former owner of the plant at Choctaw, has bought the Meridian property and is re-establishing service.

New York City—New York Telephone company has spent $55,100,000 in new construction during the first 9 months of 1925.

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